ARMY ORDNANCE

VOL. XVI, No. 96 MAY-JUNE, 1936

Industry and National Defense

Col. C. T. Harris, Jr.

The Italo-Ethiopian War

Maj. Gen. J. F. C. Fuller

Another Dardanelles "If"

George J. B. Fisher

Modern Combat Vehicles

Robert J. Icks

A Novel Machine Gun Mechanism

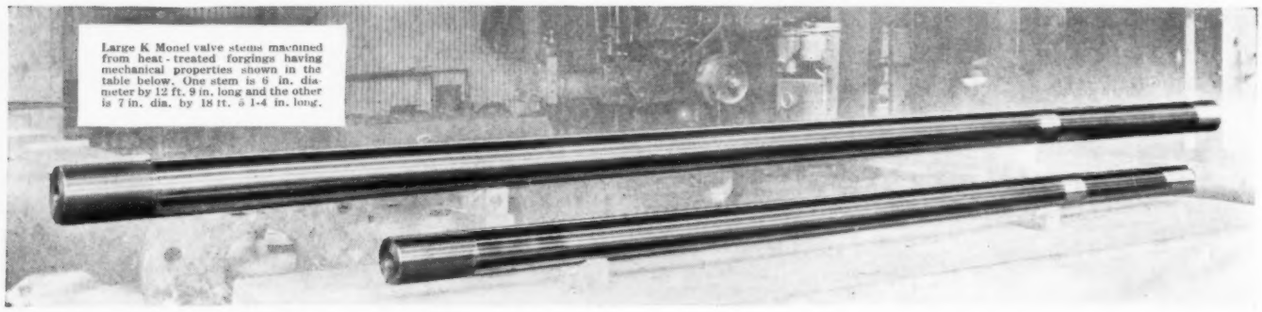
Calvin H. Goddard

Nationalization of Munitions, I

An Editorial

A BIMONTHLY REVIEW OF AMERICAN MUNITIONS
PUBLISHED BY THE ARMY ORDNANCE ASSOCIATION, WASHINGTON, D. C.

Where **MOST** *metals* **CAN'T...**
MONEL METAL DOES!



Large K Monel valve stems machined from heat-treated forgings having mechanical properties shown in the table below. One stem is 6 in. diameter by 12 ft. 9 in. long and the other is 7 in. dia. by 18 ft. 5 1-4 in. long.

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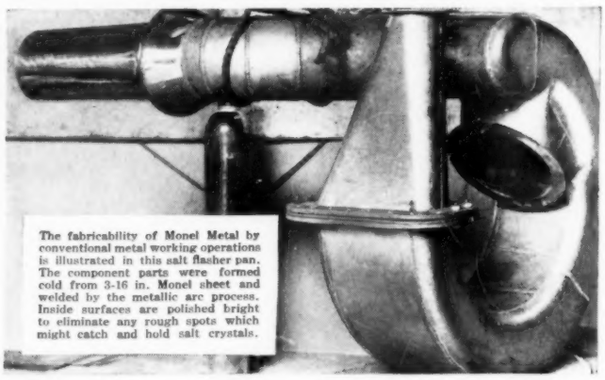

The fabricability of Monel Metal by conventional metal working operations is illustrated in this salt flasher pan. The component parts were formed cold from 3-16 in. Monel sheet and welded by the metallic arc process. Inside surfaces are polished bright to eliminate any rough spots which might catch and hold salt crystals.

MECHANICAL PROPERTIES

	STRENGTH		DUCTILITY	TOUGHNESS	HARDNESS
	Tensile Strength lb. per sq. in.	Yield Point lb. per sq. in.	Elongation in 2 in. per cent	Izod—ft. lb.	Brinell 3000 Kg.
Structural Steel (ASTM Spec. A7-33) . .	55— 65,000	28— 33,000	27—22	45 approx.	.....
Monel Metal, hot rolled	80— 95,000	40— 65,000	45—30	90—120	150—175
Monel Metal, cold drawn, rounds ½—1¼" dia.	100—115,000	75—100,000	35—15	.....	210—240
K Monel valve stems	144—160,000	101—116,000	29—22	.....	277—302

ARMY ORDNANCE

The Journal of the Army Ordnance Association

Now in its Sixteenth Year of Publication

Pledged to Public Service in Effecting Industrial Preparedness for War as Our Strongest Guaranty of Peace

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Volume XVI **MAY-JUNE, 1936** **No. 96**

CONTENTS

PAGE

MAJOR GENERAL FRANK R. McCOY - Frontispiece

INDUSTRY AND NATIONAL DEFENSE - - - - - - - - - - - - - - - - By Col. C. T. Harris, Jr. 331

A NOVEL MACHINE GUN MECHANISM - - - - - - - - - - - - - - - - By Calvin Goddard 336

THE ITALO-ETHIOPIAN WAR - - - - - - - - - - - - - - - - - By Maj. Gen. J. F. C. Fuller 340

PERPETUATING OUR MILITARY PAST - - - - - - - - - - - - - - - - By Verne E. Chatelain 349

THE BALLISTIC EQUITY OF DUELS - - - - - - - - - By Aiken Simons and Wallace H. Coxe 354

ANOTHER DARDANELLES "IF" - - - - - - - - - - - - - - - - - - By George J. B. Fisher 356

TWO MODERN COMBAT VEHICLES - - - - - - - - - - - - - - - - - - By Robert J. Icks 361

EDITORIAL - 363

Maj. Gen. Frank R. McCoy—Our Army Program for 1937—Ammunition Supply—Col. Beverly Wyly Dunn—The Nationalization of Munitions, I—Background.

ASSOCIATION AFFAIRS - 369

Directors' Meeting—Los Angeles Post—Army Ordnance Association Scholarship Keys—New Members—Necrology.

ORDNANCE FIELD SERVICE - 371

Ammunition Supply, Part I, by Maj. Raymond Marsh.

CHRONICLE - 375

PROFESSIONAL NOTES - 378

Armor Plate Planer—Ordnance Patents—Military Chess Brought Up To Date, by F. W. Foster Gleason—Titanium Pigments.

BOOK REVIEWS - 383

INDEX OF ADVERTISERS - 391

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"We should be blind to existing conditions and should allow ourselves to become foolish idealists if we did not realize that, with all the nations of the world armed and prepared for war, we must be ourselves in a similar condition, in order to prevent other nations from taking advantage of us and of our inability to defend our interests and assert our rights with a strong hand."—*President William Howard Taft, Inaugural Address, March 4, 1909.*

The Army Ordnance Association

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guaranty of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

THE Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

The Association is devoted solely to the national defense; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration. Membership, to which American male citizens are eligible, is four dollars a year.

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guaranties of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect cooperation with American scientists, inventors, engineers and manufacturers in civil life and the regular and reserve officers of the Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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Photo: Signal Corps, U. S. Army

Major General Frank R. McCoy

Commanding General, Second Corps Area

ARMY ORDNANCE

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Industry and National Defense

Guiding and Utilizing the American Industrial Effort in War

By Col. C. T. Harris, Jr.*

IT may occur to some of my readers to wonder why an Army officer of more than thiry years' active service should discuss the subject of industry in war. I shall, therefore, attempt to qualify myself as a creditable witness on this subject. Due to the many confusions, delays, uncertainties and misdirected efforts of the Government in guiding industry in the World War, the Congress, after full consideration, decreed, in Section 5a of the National Defense Act, that in time of peace an activity concerned with planning for the utilization of industry in war should devote itself to the very important subject of planning for procurement in war and for the assurance of the adequate mobilization of industry in support of the military effort. This responsibility was placed upon the Assistant Secretary of War and that official has organized in his office a Planning Branch to which he has delegated the duty of carrying on for him through the peace years a continuing study of and a continuing plan for this very important part industry will play in a war effort. I am the present Director of this industrial planning agency. As to my personal relations to the subject, I might state that out of my thirty-three years' active service, twenty-five of those years have been spent in the Ordnance Department, which as you know, is a semi-industrial department and its duties are more related to industry than they are to strictly military activities.

While I am an Army officer and while my present job is planning for war, I should like to state that I am strongly opposed to war. I consider war to be the most futile undertaking any nation can engage in, and that in modern war even the winner becomes ultimately a loser. Even though we all deprecate war and feel that it is an unhappy undertaking, it must be remembered that every generation in the United States born prior to 1918 has seen a war. Until human nature can be changed it is only logical to expect that the future will bring more wars. If wars are bound to come, it is our duty so to plan as to minimize the harmful effects of war and to insure that this nation be victorious.

THE subject I have chosen—Guiding and Utilizing the American Industrial Effort in War—is a very broad one, and each of at least twelve different elements of this broad subject could be elaborated upon at length. However, I shall attempt sketchily to portray the subject.

In war the military effort, that is, the actual clash of combat, decides the issue, but the munitions used in the military effort must come from the industrial effort. In modern war, the conflict has become one of entire nations rather than of small groups of selected armed champions. Consequently, every element of national life has its important place along with the strictly military effort. The national morale must be maintained at a high level. The civilian population must be fed, housed and clothed just the same as the military forces. Therefore, the industrial effort must provide for the needs of the armed forces and likewise for the needs of the nation as a whole.

The United States is potentially the strongest military nation in the world. We have a tremendous reserve of man power, and this man power is of a high degree of intelligence. We likewise have the strongest industrial structure and we are provided by nature with the strongest reserves of raw materials of any nation. American industry produces almost one-half of the world's goods, and uses in that production almost one-half of the world consumption of raw materials. Even with this potential strength of man power and matériel power, the United States almost inevitably enters every war unprepared. The psychology of the American people seems to dictate that adequate preparation for war shall not be made until war has been declared.

There is one phase of war-making in which, in the next war, I feel that we shall be much better prepared than in previous wars, and that is in the utilization of American industry. The purpose of planning in time of peace is to achieve this end, so that the power of American industry can be harnessed to the industrial load required in war without undue confusion and without undue upsetting of the usual production activities of the country. Unless we can enter the next war better prepared for the utilization of American industry, there is no excuse for the existence of the organization of which I am now a member.

The War Department is only one of the armed services in war. The Navy Department is of equal importance and its needs must receive the same consideration as the needs of the War Department. To coördinate problems relating to Army and Navy procurement so that an equitable distribution of production may be assured to each, the Army and Navy Munitions Board has been created and is charged with the coördination of all procurement planning of the two services. This Board is now engaged in the allocation of manufacturing facilities to the Navy on the one hand and to the Army on the other hand. In the case of many plants which would have to serve both the Army and Navy, equitable distribution of the capacity of these plants is being recorded and assigned to the respective services. In our planning to use

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industrial plants we are endeavoring to make of record the exact load that we expect to place on these plants so that a national superagency created in the next war, such as the War Industries Board in the World War, will be able to ascertain from our records the extent to which our orders will utilize the capacity of American industry to produce.

Since modern war has developed into a struggle involving every element of the nation—raw materials, manufacturing capacities, food, fuel, transportation—and since these elements have to be coördinated in full support of the military effort, it was found necessary in the World War to create a coördinating organization known as the War Industries Board. Mr. Bernard M. Baruch was chairman of this board. This organization did not in any way supervise the actual procurement functions of Government agencies, but it did make available to the procurement agencies, in accordance with established priorities, the contributory elements such as power, fuel, transportation, raw materials, manufacturing facilities, and financial assistance. Such a superagency, which is superimposed upon all other executive departments in the pursuance of an industrial effort, becomes national in character and, therefore, operates directly under the President and in conformity with national policies prescribed by him. We visualize that in a future war the creation of such a superagency or agencies will again be necessary and in our plans we have provided for this contingency. These superagencies are not under military control at all, but are administered by outstanding civilians. Care has been taken to avoid the undemocratic method of attempting to place military control over these purely civilian and industrial control agencies. General speaking, the industrial controls discussed later are administered by such superagencies.

IN planning for industry's utilization, there is the Government side of the picture and there is the industry side. Most of the uncertainties and delays of the World War were caused by failures on the part of the Government to clarify its own objectives—failures to state definitely what it wanted both in quantity and in quality. Constantly shifting programs added to the already great amount of confusion. To clarify the objective of industry in war the Government must determine and set forth clearly to industry the following: 1. How much is wanted—that is, *requirements;* 2. What is wanted—that is, a statement of the *standard* or the *type* desired, together with *specifications,* and 3. The business arrangements that the Government desires to enter into with industry—this includes *contract forms* and *contractual procedure.*

Requirements for material depend upon the organizations to be mobilized, the equipment for these organizations, maintenance and replacement factors and similar data. All these depend upon the man power mobilization plan. When these quantities needed have been computed, they define the size of the procurement program. Standards and specifications are evolved from engineering designs of weapons and other military equipments which the Army needs. The fighting branches are given the determining voice in what weapons they shall use. When a final decision has been made as to the type, specifications are prepared and become available to industry for its manufacturing program. In clarifying the objective, the procurement load must be apportioned to geographical districts in the United States so that each shall bear a full and equitable share. The procurements required of industry must be brought to the attention of industry to see whether or not it will be possible for production to be accomplished in the quantity and in the time required. Much consideration has been given in recent years to the legal agreements between the Government and industry that will be put into effect in war and as a result of these discussions and deliberations standard contract forms have been tentatively approved and are now available in case of emergency. These contract forms cover both construction and manufacturing activities and are of a character to provide for either fixed price or for some kind of adjusted compensation based upon the cost of the work. This latter contract is in the nature of a cost-plus contract with objectionable features removed.

I SHALL now discuss briefly the steps that have been and are being taken to gain this procurement objective. The War Department is convinced that in time of war the problem is so large that procurement must be decentralized and therefore the United States has been divided into geographical districts. Each of the Supply Arms and Services (the Ordnance Department, Quartermaster Corps, Air Corps, etc.) delegates to these geographical districts certain defined responsibilities in the inauguration and guidance of the procurement program. New York City is the headquarters of a procurement district for each and every one of the seven supply branches. The Ordnance Department has fourteen procurement districts, which is the largest number. Some of the others of the supply branches have as few as four procurement districts. The remainder range in between these numbers. To the head of each of these districts has been assigned a qualified, outstanding man as chief.

The production capacity of the United States has been surveyed; the production capacity of some twenty thousand individual plants has been analyzed, and the capacity of these plants to manufacture war materials has been determined. Twelve thousand of these manufacturing plants have been allocated or assigned to one or more of the supply branches for the purpose of producing military supplies. In the case of each of these twelve thousand facilities, the War Department has completed or is now engaged in the process of acquainting them with the task that will be placed upon them in war. The manufacturing plant, after examination, states to the War Department whether or not it can be depended upon to carry out the mission assigned to it with reference to both quantity and time. The great majority of these plants has signed a paper, known as the "Accepted Schedule of Production," which states that they will be prepared to perform the work assigned. This "Accepted Schedule" has no legal status and is not binding on either the Government or the industrial plant. It simply means that the industrial plant has coöperated with the Government in studying and analyzing the war load that may be placed upon it, and is prepared to carry this load in war.

I stated before that contractual procedure is a very important element in the procurement of war supplies. The existence of definite and workable contract forms which industry will accept and feels are just, will eliminate much confusion in reaching the necessary agreements so that production may be started. In time of peace, all Government procurements are required by law to be placed after com-

petitive bidding. Section 3709 of the Revised Statutes requires this method of procurement in time of peace. In war the provisions of this section will be done away with and in a large portion of the procurement of war supplies prices will be fixed by negotiation. The experience of industry and of the War Department in normal production should form a guide as to what constitutes a fair price. In the case of some noncommercial articles, an estimate of cost will not be possible due to industry's unfamiliarity with the product. In such cases an adjusted compensation form of contract will be required. Space does not permit the full development of this subject.

Other important elements of contract procedure are those of inspection and payments as well as the provisions for settlement of contracts after the war is over. Inspection is a very important phase of procurement. Good inspectors are not plentiful. Poor inspection can err on the side of being either too arbitrary or too lenient and poor inspection may embarrass very seriously the production program. The War Department is giving much consideration to this question of inspection in the preparation of inspection manuals and other inspection data which should be helpful to inspectors under war conditions.

IN discussing the industrial effort in war, the comparative ease or difficulty of certain procurements is worthy of note. More than one-half of the money expended by the War Department in war will be used to procure articles strictly commercial in nature—food, clothing, shoes, automotive transportation, etc. This commercial industrial load can be assumed rather easily by American industry, as it is of the same production character that these industrial plants have been engaged in under normal peace-time activities. On the other extreme, we have the strictly noncommercial items, such as guns, recoil mechanisms, ammunition, combat cars, and similar items. Here industry is not so well prepared to assume the load, since it is unfamiliar with the product required, and the manufacturing activities involved are of a character entirely dissimilar to those used under peace-time production. In the case of explosives, propellants and the assembly of ammunition, there are no comparable peace-time activities, and this new industrial activity, which will cost several hundred million dollars in facilities alone, will have to be built from the ground up. Another phase of the industrial war load has to do with the requirements for special and alloy steels, far in excess of the normal peace-time production. There is no particular difficulty in connection with the production of the quantity of steel required, since the American production of steel far exceeds the military requirements in war, but the normal production of special quality steels is inadequate. I mention these matters simply to show the complexity of the problem.

I should like to discuss briefly one activity of industrial planning that may serve to illustrate our procedure, that is, the preparation of a Government steel plan for use in war. In 1924, the War Department, in collaboration with the steel industry, inaugurated the preparation of a steel plan for use in war. This plan was completed in 1927. The plan consisted of three parts: *Part I.* A statement of steel requirements—first, military requirements for the Army and the Navy; second, shipping requirements; third, railroad requirements; fourth, other national requirements. This volume set forth as far as could be portrayed at that time the requirements of steel which the steel industry would have to meet in war. *Part II* of the plan consisted of a statement or tabulation of the steel production capacity of the United States. The figures of the American Iron and Steel Institute were used in the preparation of this part of the plan. *Part III,* which really is the plan itself matched the requirements against the capacities and set forth for each supply arm and service of the War Department, and for every other national agency using steel in war, the source from which they would secure the tonnage of steel required for their program. This part of the plan was broken down in such detail as to show for each procurement district of each supply arm and service of the Army which particular steel plants would supply the quantity of steel for the war load placed upon the procurement district. In 1934, due to the increased use and requirements for special and alloy steels, it was decided to revise the 1927 steel plan. An outstanding officer of the Ordnance Department, who is an expert on steel production, was assigned this task and has been engaged thereon for approximately two years. The requirements and the capacities were revised and the apportionment of capacity credits in *Part III* is just now being completed. This revision has been carried on in collaboration with the American Iron and Steel Institute. This body has given full coöperation and assistance in this work and I believe I am correct in stating that the American Iron and Steel Institute considers the preparation and periodic revision of such a plan a very constructive step in industrial planning, and that the existence of such a plan if war should be declared would be of inestimable value in coördinating and clarifying the production of the steel reqirements.

IN my opening remarks, I mentioned the fact that the United States was unusually blessed by nature with the existence within our borders of most of the essential raw materials required by industry. In this respect we are unquestionably the most favored nation in the world. We have in this country ample sources for our full requirements of food, coal, petroleum, power, iron ore, iron and steel, machinery, chemicals, copper, lead, nitrates, silver, cotton, zinc, and phosphates. No other nation can match this superb list of national resources. Even though we have so many essentials available there are some raw materials in which our domestic production will fall far short of supplying the national needs. There are some twenty to twenty-five of these so-called strategic materials, of which some nine are minerals. I will mention a few of the outstanding raw materials for which we must depend upon foreign sources to meet our national needs either in peace or in war:—

1. *Manganese*—a metal used in modern steel making for the purpose of cleansing and deoxidizing molten steel. Manganese likewise lends beneficial qualities to the finished steel product. Domestic production under forced draft could not produce more than twenty or twenty-five per cent of our needs in two years of war. The remainder of that required must come from stocks in reserve in this country in the hands of steel companies or from imports. The principal world sources of manganese are Russia, India, Brazil and the Gold Coast of Africa.

2. *Tin* is another of the metals and in this case there is no domestic production of the primary metal, although there is an appreciable secondary recovery from scrap metal. This

secondary recovery of tin is important in war as it may supply as much as thirty per cent of our requirements. The remainder must come from foreign sources. Tin is used principally for solder, bearings, and linings for metal containers. Food is largely distributed in tinned cans.

3. *Nickel* occupies a unique place in the world's raw materials in that practically the whole world supply is concentrated in Canada, not two hundred miles from our own border. We have no domestic production of nickel. In time of war, if the flow of nickel from Canada to this country were stopped, our situation with reference to nickel would be serious indeed. Nickel is necessary for steel alloys.

4. *Chromium* is a mineral for which the demand of industry is continually increasing. Chromium is used largely in rust-resisting alloys and, of course, has many other uses. We have some domestic production of chromium but it would not suffice our war needs.

5. *Wool* is a raw material of which our domestic supply might popularly be considered to be sufficient, but such is not the case. In time of war due to the increased demands for wool, when four or five million soldiers and sailors are dressed from the skin out in new wool clothing, our domestic sources would not supply more than one-half of our requirements.

Many of the raw materials for which domestic production is insufficient can be secured from other nations in North and South America and this class of strategic materials can be more easily obtained than those which come from more distant sources, as for example tin. In connection with strategic raw materials the Government agencies have given much consideration to the use of substitutes, for example, using cotton, of which we have an ample supply, as a substitute for jute, Manila fiber or sisal; using fabrics and artificial leather for real leather, and many others. In connection with the use of substitutes, the following word of caution should be stated. A substitute relieves the pressure on the requirements for the original material, but the use of a substitute tends to disarrange normal production methods. In the use of substitutes the advantages and disadvantages must be weighed. My feeling is that if it is at all possible to obtain the materials that industry has been accustomed to use we should do so.

In dealing with industry in the World War, the War Industries Board evolved the use of so-called war service committees. These were representatives from allied groups in industry and these committees assisted the Government by recommending constructive measures to utilize to maximum advantage the manufacturing and other industrial facilities of the nation. When the N. R. A. was established, it provided for code authorities which would likewise represent industry. The germ of the idea for these code authorities must have come from the War Industries Board's war service committees. In the plans of the War Department we provide for use in the next war of war service committees. The members of these committees are chosen by industry itself and are supposed to represent the interests of industry. There will be established within the Government itself, small government agencies called commodity committees which cover the same field as the war service committees. For example, there will be a Building Material Commodity Committee—a group on the Government's side to represent and protect the Government's interests—and linked loosely with that commodity committee will be a war service committee from industry to present industry's interests and to advise as to the most effective use of industry's capacity in meeting war requirements. Thus the Government reserves to itself the right of decision but secures from industry the best available advice as to the most efficient method of solving the particular problem involved. It must, of course, be appreciated that the members of the Government's commodity committees must not be financially interested or benefited by decisions made affecting industrial activities, and in which decisions they have had a part.

We now come to a subject that has been discussed far and wide—profiteering in war. Increased demand for all materials in war and competition between Government agencies for these materials, unless controlled and coördinated, must inevitably result in higher prices. Higher prices, with a rising market, make undue profits not only for industry but for every holder of any material used by the nation. There may be undue profits in food, in farm products, and in raw materials, as well as in the manufacture of munitions. In fact, there may be undue profits in any transaction. To state that a munitions manufacturer is a profiteer may be a true statement, but anybody who makes undue profits in anything else in war is likewise a profiteer.

We believe that procurement planning if comprehensively developed will in itsef largely prevent profiteering, if certain industrial controls are made effective. The assurance that the procurement program has been in time of peace clarified and presented to industry, that Government services will not compete against each other for the products of industry and that good business arrangements are made, including fair contracts, together with the power for price fixing and a fair excess profits tax, will go far toward preventing profiteering in war.

The next subject of my discussion has to do with the necessity for Government control of industry in war. Effectively to support the military effort in war, industry must of necessity be guided by the needs of the Government. War-time industrial controls must be made available and used. Many things can be done under the Constitution in war that would not be constitutional in time of peace. The war-time powers of the President, the war-time powers of the Congress, the law of eminent domain and the law of necessity in time of war will cover almost any action that is needed to achieve victory. The following industrial controls are necessary to stabilize prices, to stabilize fair compensation and to hold down the cost of war: the power of price fixing; the power to assign priorities; the power to requisition and sell materials; the power to enforce conservation measures; the power to place compulsory orders for materials; the power to commandeer, and the power to license. All these controls should be made available, but that does not necessarily mean that they will all be used. The power of commandeering might well be compared to a policeman's club—it is always in evidence but seldom used.

I should like to discuss briefly some of the practical workings of these industrial controls that I have mentioned here.

Price fixing. There are two schools of thought on the application of price fixing in war. The first may be defined as placing a ceiling over all prices as of a given date before

the war, this ceiling to be clamped on immediately after war is declared. Thereafter no price may exceed the ceiling price; on the other hand, if economic conditions permit, the price may go down. The other school of thought feels that price fixing should be resorted to in the manner and to the extent that current conditions should dictate. This school of thought believes that perhaps the first step in price fixing should be a fixing of prices in certain basic raw materials and then as a later step extending the fixing of prices to the other industrial elements. This idea might be defined as a successive fixing of prices, depending upon the need therefor.

Priorities. This term means setting preferences for essential things—the power to say to industry, "you shall do this first and you shall do that next"; the power to say to transportation companies, "you shall haul this first and that next" —the power to state "you shall not haul that until all of these other preferred items have been moved"; the power to state that "no raw materials shall be furnished for a particular project which may be considered nonessential." You can readily see what a powerful control weapon this could become.

Conservation. This includes the power to prevent waste; the power to prevent dissipation of our resources; the power to prevent gasoline wastage on useless Sunday travel; and the power to cut the cuffs off men's trousers to save wool; the power to limit models for shoes and other wearing apparel to a few standards to save necessary materials or labor.

Requisitioning. This includes the power to take for use by the Government any material or material thing in the nation and pay therefor a fair price, this to insure to the national Government the use of every national resource in the application of a military effort.

From the above it can be appreciated that these control powers are drastic and could not possibly be applied, except under the exigencies of war. I repeat what has been stated elsewhere, that it is necessary to have these control powers, but that it does not necessarily mean they will all be used. The mere existence of such powers will make their use in many cases unnecessary.

THE War Department and the country at large have been cognizant of the fact that during the World War undue profits were made by some American dealers, producers and manufacturers and the War Department since the war has coöperated in every reasonable effort to prevent profiteering in war. The American Legion very shortly after the Armistice adopted as one of the planks in its convention platform that industry should be drafted in war as well as man power. All elements of the nation feel that burdens should be borne equally by all. Many bills have been introduced in Congress with these objectives in view. In 1931, a War Policies Commission, created by Act of Congress, and composed of Cabinet officers, Senators and Congressmen, held extensive hearings at which all desiring to speak were heard and as a result of these hearings recommendations were submitted to Congress. The War Department participated in the proceedings of this commission and presented to it pertinent studies relating to procurement and industrial planning and to industrial controls required in war. In 1933, the War and Navy departments, in coöperation, prepared the Industrial Mobilization Plan that is now current. This Industrial Mobilization Plan was approved by the Secretary of War and by the Secretary of the Navy and contains the organizational and control provisions that the War and Navy departments consider are necessary for the mobilization of industry in support of the military effort in war.

In the last session of Congress, the House Military Affairs Committee introduced and secured the passage of H. R. 5529 which provided for price fixing, priorities, commandeering, requisitioning and licensing in relation to materials and industrial organizations in war. This bill likewise provided for an excess profits tax. When the bill reached the Senate it was referred to the Special Senate Committee Investigating the Munitions Industry, of which Senator Nye is chairman. This committee has held long and exhaustive hearings. The Nye Committee amended H. R. 5529, practically rewriting the bill and providing a very drastic tax measure for war as well as providing for the industrial controls needed. The bill was then referred to the Senate Military Affairs Committee where it was again materially modified and after hearings, was recommended favorably for passage by the Senate. The bill is now before the Senate Finance Committee for consideration of its excess tax and other tax provisions. The War Department has gone on record as supporting the industrial provisions which provide for control measures in war. The War Department has refrained from discussing the tax provisions, feeling that this was a responsibility of other executive departments and of the Congress, rather than of the War Department. The War Department has set forth that an excess profits tax will be necessary to assist in preventing undue profits in war, but that on the other hand tax measures must not be so restrictive nor so onerous as to hamper or destroy the more important thing of producing munitions when required. The Secretary of War in appearing before the House Military Affairs Committee about one year ago said with relation to this subject: "Price fixing is a very important element in preventing profiteering in war, but it is not the *only* element. Price fixing by itself cannot accomplish this meritorious result. It must be supplemented by fair contracts and effective contractual procedure and by a proper excess profits tax."

While some of the control measures discussed above may appear harsh and arbitrary, it is not desired to convey the thought that we are hard-boiled in our attitude in planning for the control of production in war. On the other hand, all the War Department plans have been conceived in the spirit that both industry and labor will coöperate fully in this national effort in war.

The Planning Branch has been in existence for some fourteen years, engaged in planning for the industrial participation in war. Much has been accomplished, but much remains to be accomplished. We who have been engaged in this work of industrial planning, believe that our efforts, supplemented by the assistance of industry, have materially clarified the problem and that we can be assured that this country will enter the next war, if one should unfortunately come, far better prepared to utilize effectively the industrial power of this Nation.

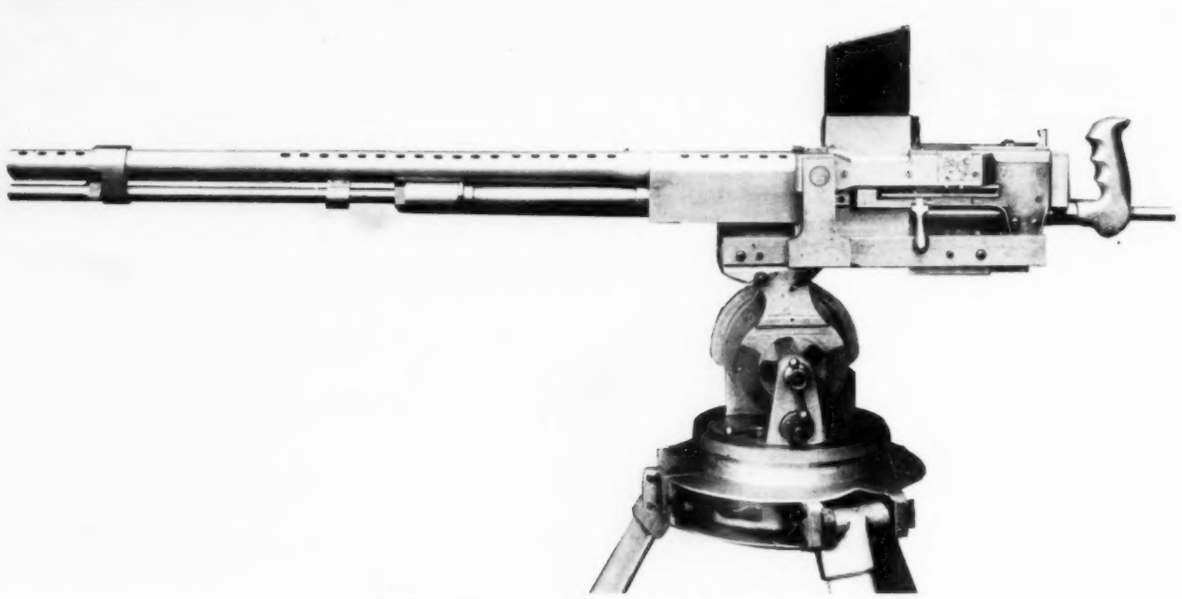
Editor's note: This article by the distinguished Director of Industrial Mobilization Planning, Office of the Assistant Secretary of War, was originally delivered as an address before the New York Metropolitan Section of the American Society of Mechanical Engineers. It is of such timely importance that it will be published separately as a reprint from ARMY ORDNANCE for gratuitous distribution to all requesting it.

A Novel Machine Gun Mechanism

The New Gas-set, Spring-operated Weapon

By Calvin Goddard*

EMPEROR NAPOLEON III, in the preface to his treatise "On the Past and Future of Artillery" [1] tells us that progress in ordnance is hindered by two formidable enemies, viz., ill-considered inventions, and *routine*, and that the deadlier of these is routine. As an example of an ill-considered invention, he describes a 14th century "organ gun", the medieval equivalent of our modern machine gun, which embodied rows of barrels ranged in several tiers, and fired 140 balls at one discharge. Obviously, considering the difficulties involved in attempting to make such a gun operate successfully in those days and times it *was* ill-considered, because untimely. Five hundred years later it would write history.



REDUCED-RECOIL MACHINE GUN, CAL. .30

Experimental Mount, Air-cooled, Experimental 20-shot Magazine in Place (Finished Model to be Belt-fed).

The same untimeliness was of course true of all similar weapons developed prior to the perfection of metallic ammunition. Yet many of these were born, on paper at least, in the brains of ingenious inventors, and are found today recorded in musty volumes in the form of patent applications and letters patent. Nor is history without evidence of their actual tactical employment, for Dittrich tells us that a medieval "organ gun" was used by the Venetian General Coleoni at the Battle of Picardina in 1467 [2].

As to that still more potent enemy of progress, routine, or what might more aptly be termed "official inertia", examples of its operation to the hindrance of all types of scientific advancement, military and otherwise, are too numerous to mention. The old die-hards who decried the breech loader because it could never be supplied with an adequate amount of ammunition for battle purposes, or their sons who fought the repeater for the same reason, live again in those who fear that the semiautomatic shoulder arm will bring with it insurmountable problems of similar nature. Tradition indeed dies hard, and even as recently as the late 80's many and acrimonious were the polemics between advocates of muzzle- and breech-loading systems. But a classical example of its survival involved a certain British artillery officer of the 1840's who had no use for rifled field pieces because Waterloo had been won without them!

Unfortunately, the profession of arms, in common with all the others, is prone to exhibit from time to time instances of such "routine", to its own disservice in general and in particular to that of those within it who are attempting to effect long-needed reforms or innovations. Whether it ever manifests any such flagrant instances of tradition-worship as have been ascribed to such professions as law and medicine we know not—and hope not. For, among the latter spheres there is record of an authentic instance in which a British judge, witnessing a murder, later sentenced to death for the offense an innocent man who, under torture, had confessed the crime. This action he justified on the basis that his ruling in such a matter ought not be affected by personal knowledge on his part of facts not adduced in evidence! And history tells us that the use of anesthesia in childbirth was, for years after its introduction, violently opposed by millions of worthy souls, physicians included, who held that God had intended woman to suffer the pangs incident to this phenom-

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1. *Du Passe et de l'Avenir de l'Artillerie, avant propos. Napoleon III*, Paris, 1856.

2. Dittrich, "Machine Guns and Their Employment".

enon, and that any attempt to alleviate them would be in direct conflict with His holy will!

Possibly we shall some day learn of an entire command, armed with a new and superior weapon, refusing to employ this, and permitting itself to be wiped out by a weaker force because the new arm had not as yet been "officially" approved. Until then, however, the palm for "routine" stands divided between the judiciary and the disciples of Aesculaepius.

WHILE practically all early quick-firing pieces involved merely variations of the same general design, i.e., the arrangement of a number of musket barrels in rows, to be fired simultaneously or in rapid succession, at least one inventor developed something much more closely approaching modern types. For in 1717 one James Puckle [3] patented a gun with but one barrel into which charges were fed successively from a revolving cylinder, this being quickly replacable, when empty, by others fully loaded. This device has received much attention from ordnance historians, and cuts of it are reprinted from time to time, presumably because of one rather unusual feature. For the inventor, evidently a good churchman, prescribes barrels with rectangular bores, shooting square bullets for use against infidels, but others of conventional design for employment against defenders of the Faith!

But Puckle appears to have been considerably ahead of his time, for subsequent inventions continued to embody the "organ" idea (i.e., one or more rows of fixed barrels). Such a weapon, dated about 1830, appears in the Artillery Museum at Woolwich. Others, stimulated, it seems, by the outbreak of the Crimean War and the events leading up to this, were patented in rapid succession, e.g., that of Thomas (1854) which comprised some 90 rifle barrels recoiling against rubber buffers; that of Clarke (30 barrels) of the same year; of Sir John Scott Lillie (also 1854) with barrels "in a row, or tiers"; of Samuel A. Goddard, 1855 (similar to Lillie's); of John R. Reynolds (1855) "a row of fixed barrels"; of William Church (1855) "a series of barrels mounted on a *railway carriage*"; of Lillie (1855)—improvements on his designs of 1854, and of Sir Charles Shaw (1858) "one or more rows of barrels, preferably rifled".

And despite the appearance in 1862 of the first really successful machine gun as designed by Dr. Richard J. Gatling of Chicago, which embodied a number of barrels fixed equidistantly about a central axis, the idea of a tier or tiers of barrels still persisted, and reached a high state of development in the Nordenfelt and the Gardner. Indeed, an interesting makeshift revival of the "organ" principle was recorded during the World War, when a captured German trench revealed the presence of two rows of ten Mauser rifles, mounted one above the other on a wooden frame, their triggers all operated by wires controlled from a central working point by a wooden lever. Bolts, of course, had to be operated between each discharge, but by the use of clips five volleys of twenty shots could be fired without reloading.[4]

Early American inventors followed for the most part the conventional design calling for a "row of fixed barrels", as witnessed by the "Requa Battery" [5] with 32 of these, used during the Civil War. One, however, bolder than the rest, departed from this, and, like Puckle, employed a single barrel through which a number of charges were fired in rapid succession, being fed from a hopper above the breech. This so called "coffee grinder", also of Civil War development, is familiar to those who have visited the Springfield Armory.

Practically all of these early mechanisms when designed for mobile use were mounted on wheeled carriages closely resembling those of contemporary field pieces, and were known as "batteries" (e.g. "Requa Battery") rather than repeating guns, quick-firing guns, or machine guns. Indeed it would appear that as lately as 1859 none of these terms was in common use, as they are not to be found in a large work on arms and munitions printed in London in that year. All of these pieces, coming as they did before the advent of the perfected metallic cartridge, were "ill-conceived" and doomed to failure.

At this juncture it may not be amiss to note that research into the development of the machine gun of today shows that not it alone, but its modern teammate, the armed and armored tank as well, derives from a long, if perhaps uncertain, ancestry. Thus we find record of the issue of letters patent in the year of our Lord 1693 to James Austen and Francis Ball covering "a machine or chariott of artillery which is musket proof and so contrived as to hold two falkonetts or small field pieces, and two hand mortars to be used by the party sitting in the chariott, and may be conveyed many miles a day with great ease and expedition".

Obviously this interesting contrivance differed from the tank of World War development in that it lacked self-contained motive power, but this defect was corrected in 1855 by James Cowen and James Sweetlong who devised a "locomotive land battery," composed of a massive framework fixed on five broad wheels, and driven by a steam engine. Ordnance was set upon the framework, which was loop-holed for rifle fire.

AMONG the problems which have beset ordnance engineers since time immemorial are those of: (a) Increased range, and (b) Increased rate of fire, without in either case increasing powder charge, length of piece, powder residues, temperature or recoil. Apparently these were solved in full as long ago as 1721 by one Isaac de la Chaumette, who in that year patented "a cannon or piece of ordnance which, being charged by the breech through the barrel, is cooled by charging it and cleaned by firing it. It carries twice as far as those commonly in use, and requires but half the quantity of powder and half the length of an ordinary cannon, and *does not recoil* (italics mine) and it may be fired ten times as often as the cannon now used . . ."

Unfortunately no detailed specifications appear in the letters granted this gentleman, else doubtless our contemporary ordnance designers would have been spared many headaches—and heartaches. For imagine a gun half the length in calibres of one of our conventional pieces, yet ranging twice as far as these, with half the usual powder charge, automatically cooled in the process of loading, and without recoil. How careless of brother Isaac to have failed to record for the benefit of posterity, a complete description of this remarkable device!

While a gun embodying all of the advantages claimed by the honorable de la Chaumette is doubtless still far in the dim and distant future, yet there is no reason why some one

3. Abridgements of Specifications Relating to Firearms and Other Weapons. London, 1859.
4. "The Book of the Machine Gun." Longstaff and Atteridge, London, 1917.
5. "Machine Guns." Hatcher Wilhelm and Maloney, Manasha, Wis., 1917.

of these features, such as recoil reduction, might not be the subject of careful study and at least partial solution by a sufficiently resourceful inventor.

And recoil reduction has been one of the major aims of one R. F. Hudson, who has devised various ingenious means to accomplish this, with what ultimate success the future must reveal. Working models of automatic weapons produced under his patents in .30, .50, and 1.1-inch calibers have recently been built and tested, the last named being constructed by the U. S. Navy Department at its own expense. In addition, the adaptability of the Hudson recoil reduction principle to heavier automatic weapons up to 3-inch caliber, and to shoulder arms as well, is claimed by those familiar with its recoil reduction features. These are briefly two, the first involving the old idea of a muzzle brake, many types of which have appeared from time to time, combined with a second, new and interesting. In the latter, a moving element (piston) reciprocates on an axis parallel with and below that of the barrel, and is actuated in its forward motion by the pressure of gas derived from a conventional port, tapped into the bore, being brought to a sudden stop by impact against a fixed member designed to effect this. Its subsequent rearward motion is initiated by energy stored in a coiled spring compressed by it during its forward travel. The size and location of the gas port, capacity of expansion chamber, size and weight of piston, its length of travel, and the length and stiffness of the spring it compresses, are naturally major factors in determining its *time* of travel and consequently the instant at which it will strike the fixed element, as well as the velocity with which it impinges upon this. When these factors are so controlled that the piston strikes the element at that point on the "velocity of recoil" curve at which it will have a maximum recoil reduction effect, the arm functions at its highest efficiency. This period is understood to be one just prior to the emergence of the projectile from the muzzle.

The Hudson gun differs from the conventional gas-operated weapon in that the train of events which leads to loading, firing, extraction, and ejection does not commence when the gas, diverted through the port, actuates the piston element, but awaits full compression by the latter of the main spring, expansion of which then initiates this. Thus the arm may be described as "gas-set, mechanically operated". And since the amount of gas diverted from the bore is considerably in excess of that necessary to compress the main spring, the latter can be counted upon to function uniformly irrespective of pressure fluctuations within the bore.

Thus it is not necessary to operate this gun at minimum pressures, as in certain other types, in which we are likely to encounter trouble when medium or high pressures are developed.

WHEN the piston has reached the foremost point in its travel (i.e., halted by the fixed member), exhaust ports are uncovered through which the gases diverted from the bore are dissipated. The main spring now, uncoiling, drives the piston element and two push rods attached to it, rearward; the latter, connected with a lock-actuating member, disengages the lock and drives this and the bolt to the rear, effecting at the same time extraction of the fired case, and compression of the return spring. When the breech mechanism is in its rearward position, a clutch disengages the main spring, permitting the return spring to function. This now closes the breech mechanism and discharges a cartridge placed in the chamber during such closure.

REDUCED-RECOIL MACHINE GUN, CAL. .50, AIR-COOLED, EXPERIMENTAL MOUNT

Such, in brief, is the operation of the Hudson type weapon, which holds, with certain structural variations, for all models and calibers in which it has been designed or built. Its principles and construction have been examined carefully by various ordnance engineers, one of whom, a recognized authority on automatic weapons, has pronounced upon them as follows:

"By operating the mechanism with a positive force obtained from the mainspring which is compressed independent of the operation of the gun, the force required to operate the gun and the reaction against the mechanism of the gun can be controlled very accurately. *This makes it possible to positively control the rate of fire and to provide a gun with less trunnion reaction than any other gun operated on the principles of the old type of automatic guns.* The principle of the operation of the Hudson automatic gun *also provides the only safe means yet devised for loading supersensitive fuzes into an automatic gun with absolute safety.* This can be accomplished as the operation of the gun is

under perfect mechanical control at all times and is not subject to variation in the pressure and velocity which is found in all cartridges, and due to the fact that the gun can be stopped and started in any position of recoil or counter-recoil without interfering with its positive operation.

"The bolt is under positive mechanical control throughout its path and is not allowed to recoil into space unattached from its coördinated mechanism, as is the case with all previous guns of the automatic type. The rate of fire of an automatic gun has a direct relation with the trunnion reaction in other types of automatic guns. However, this is compensated for by the counteraction of the gas piston moving forward in the Hudson gun. The speed can be controlled at will."

REDUCED-RECOIL MACHINE GUN, CAL. 1.1-INCH, WATER-COOLED

The "only safe means yet devised for loading super-sensitive fuzes into an automatic gun . . ." referred to by this gentleman as a feature of the Hudson mechanism, consists of an antidouble loading device for halting operation of the breech mechanism should an empty cartridge case or portion thereof remain in the chamber.

Much of the virtue of the Hudson principle is attributed by its exponents to the fact that it obviously involves a greater delay in action after firing and before extracting than is found in other guns of conventional design. This obviates the extraction difficulties which arise when this operation commences at a time when chamber pressure is still relatively high. Yet this delay does not affect rate of fire, as evidenced by the fact that the 1.1-inch gun, the largest and heaviest yet built under these patents, has been successfully operated at a rate of close to 150 shots per minute, while those in smaller calibers will function at cyclic rates several times as great as this.

The gun has been pronounced by the expert above quoted, as "possessing features particularly adapted for use on aircraft against aircraft", and also "of unusual merit for an anti-aircraft gun". Although the models thus far built are air-cooled and fed from clip magazines holding but a limited supply of ammunition, contemplated service models will embody belt feeds and (for ground types) water cooling.

The 1.1-inch gun, the only model thus far subjected to official government tests, was fired on various occasions at the Naval Proving Ground, Dahlgren, Virginia, during February, March, June and July, 1933. Cyclic rates from slightly over 100 to 139 shots per minute were obtained, and "the entire performance was considered satisfactory".

As to the suitability of this gun for airplane and tank use, a naval officer of flag rank has stated: "Any automatic mechanism, to attain highest efficiency in service, requires simplicity of design, not too rigid requirements as to dimensions, freedom from delicate parts and the need for fine adjustments, and a reserve of operating energy. It is my opinion that the Hudson gun mechanism combines all these qualities and is so designed as to be unusually well adapted for a dependable, rugged and positive gun action.

"There appears to be no reason why the same design of mechanism cannot be used for all calibers up to 2 or 3 inches, or even larger, these being especially desirable for antiaircraft purposes. The limit in size appears to be that beyond which the ammunition itself cannot be handled automatically. The smaller calibers will be specially suitable for mounting on aircraft.

"A large caliber Hudson gun mounted in an airplane with a range of several miles can deliver short strings of explosive projectiles at the rate of 600 or 800 rounds per minute with great accuracy. Because of practically no recoil, operations should be nearly as stable as though fired from the ground. The effect of these rapidly fired strings will be almost like salvos. All other guns of recoil type, except of small caliber, would either destroy the control of a small plane or make it so unstable as to make accurate firing impossible. This is the reason that no large guns are now used on airplanes.

"This gun may also be mounted in a tank, and operated with freedom, because of a short receiver, or breech block housing, due to the absence of recoil mechanism. The caliber .50 solid bullet will penetrate the steel used in tank construction at battle ranges.

"The Hudson gun of over 1-inch caliber, firing sensitive-fuzed shells at a rate of 200 per minute, exploding on contact, will be far more effective against tank operations (or in any other action) than the guns of any other type available today, since the latter are manually operated and fire time-fuzed shells at a comparatively slow rate of speed.

"The foregoing represents conclusions based upon a study of the .50 caliber gun and the mechanism design, and full discussions with patent attorneys and ordnance experts who are thoroughly familiar with the gun and its actual performance."

So much then for Mr. Hudson and his gun. Possibly the experts above quoted were overenthusiastic—possibly insufficiently so. Time will tell.

The Italo-Ethiopian War

A Military Analysis by an Eye-witness Observer

By Maj. Gen. J. F. C. Fuller*

WHEN, late last September, it was decided that I should go to Eritrea as special correspondent to the *Daily Mail*, though my information was of the meagerest I set about appreciating the military situation.

The first thing which struck me was the size of Abyssinia, and the second its strategical security. Topographically this country, nearly as large as France and Germany together, may be divided into three main areas, which I will call A, B and C. The first includes the whole land lying west of longitude 40°, and consists of a jumbled mass of mountains and valleys; the second covers Danakil and Aussa, north of the great Addis Ababa-Harar spur, and the third the Ogaden country south of it and abutting on Italian Somaliland. In these three areas the climate differs markedly: in A it is temperate, in B, unbearably hot, and in C, tropical in the south and temperate in the north. Generally speaking, water is scarce, except during the rains. In short, strategically, Abyssinia is like a porcupine bristling with quite exceptional difficulties.

What of its inhabitants who number something between seven and ten millions? They comprise a jumbled mass of peoples and races, the political and social structure of which is shaped by three factors—religion, feudalism and slavery. The first is part Christian of a debased magical kind, part Mohammedan, and part pagan, and the second is of a loose, early medieval European order. The Negus, or Emperor, is King of Kings, the Kings being represented by the Dedjacs, Rases, etc.—barons and chieftains who, possessing armed bands of their own, are frequently at war with each other and not infrequently at war with their overlord. From this it will be seen that the Abyssinian political system differs greatly from the Italian; for whilst both are autocratic, the first is very loosely and the second very firmly centralized.

Turning to resources, so important in war, whatever may be the undeveloped wealth of the country, the developed is limited by slavery on the one hand and lack of communications on the other. The first kills initiative, and combined with the feudal system establishes militarism as the sole pastime of the Rases. The second maintains the country in a state of chronic poverty which, when coupled with the military spirit, breeds cupidity among the Rases, a strategical factor which was made the most of by General Napier nearly seventy years ago.

Again, as the feudal levies are no more than loosely knit bands of armed men lacking in organization and means of supply, in order to live they are reduced to foraging, which means either limited concentrations, temporary concentrations, or movements governed not by strategical requirements, but by economic needs.

Bearing this point in mind, it at once struck me that lack of communications was the Negus' greatest tactical asset; because, as his feudal bands possessed but the most rudimentary supply organization, to them roads were nothing like so vital as to the Italians. Consequently, strange as it may seem, my opinion was that, from the Abyssinian point of view, the Addis Ababa-Jibuti railway and the Harar-Berbera road were strategically a disadvantage. True, they enabled supplies to enter the country; but truer still, they presented the Italians with a real objective to strike at. Without the railway, Addis Ababa, though it might remain the capital, would be like any other town, but linked by it to outer civilization it became a capital fixed. In consequence its cutting would not only be an economic set-back, but an overwhelming moral blow, because once cut, the capital would be strangled, and once strangled, the hub would be knocked out of the Negus' feudal wheel.

I NEXT turned to a very important factor, namely, the approaches through the three areas into which I had divided the theatre of war. First there is Napier's old track running from near Massawa, the Italian northern base of operations, southwards towards Dessye and thence to Addis Ababa; secondly, there is a track from Assab in southern Eritrea across the suffocating Danakil and Aussa provinces towards the railway, and thirdly, several towards this same objective from Italian Somaliland, of which the most likely appeared to me to be that of the Shebeli river north of Mogadishu. In order to relate them to the three main subdivisions of the theatre of war I will call them *a*, *b*, and *c*.

Having completed this brief survey, and remembering that in weapon power, means of transport and supply, the Italians were incalculably superior to the Abyssinians, it seemed to me that the war would take the following form: That the Italians would establish their base depots at Massawa, Assab and Mogadishu, and simultaneously advance along all three approaches. Along *a* I expected to see an advance of mobile columns composed of Alpini regiments and units which had been put through if only a brief course of mountain warfare training; their object being not to occupy Addis Ababa, but to distract the enemy's attention and induce him to concentrate his main strength in country in which he felt he could fight more advantageously. The aim being to draw his fighting forces away from *b* and *c*.

Along *b* and *c* I expected to see highly motorized and mechanized columns strongly supported by aircraft pushing forward; their object being the railway. As regards column *b*, the distance it would have to traverse was some 300 miles, and for column *c* about 500. Therefore at an average advance of ten miles a day, I considered that the railway would be reached in about seven weeks. From there an advance could be made on Addis Ababa, a distance of 250 miles, and moving at the same average speed, this would take four weeks. In

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*Author: "Hints on Training Territorial Infantry", 1911; "Training Soldiers for War", 1914; "Tanks in the Great War", 1920; "The Reformation of War", 1923; "Sir John Moore's System of Training", 1925; "British Light Infantry in the Eighteenth Century", 1925; "The Foundations of the Science of War", 1926; "Imperial Defence, 1588-1914", 1926; "On Future Warfare", 1928; "The Generalship of Ulysses S. Grant", 1929; "India in Revolt", 1931; "Lectures on F. S. R. II", 1931; "Lectures on F. S. R. III (Operations Between Mechanized Forces)", 1932; "War and Western Civilization, 1832-1932", 1932; "General Grant (A Biography for Young Americans)", 1932; "The Dragon's Teeth (A Study of War and Peace)", 1932; "Generalship, Its Diseases and Their Cure", 1933; "Grant and Lee (A Study in Personality and Generalship)", 1933; "Empire Unity and Defence", 1934; "The Army in My Time", 1935; "Memoirs of an Unconventional Soldier", 1936. Major General, British Army, Retired, C.B., C.B.E., D.S.O.

This article will be a chapter of a book on Abyssinia which will be published shortly. The remaining chapters in the forthcoming volume are by other journalists who served as correspondents in Abyssinia. General Fuller was special correspondent for the London *Daily Mail*.

all this would mean roughly three months, or say four, allowing for unseen contingencies. I did not consider this an impossible task, seeing that, in 1868, Napier had marched a similar distance, 758 miles, in about the same time.

It will be seen from this project that my opinions were exceedingly optimistic. I expected the war, should it begin in October (as it did) to end by February, that is to say its military phase. How long the pacification of the country, its police phase, would take I had no idea. So with this picture in my mind as a background to work upon, I set out from London to the seat of war on October 3rd.

MAJ. GEN. J. F. C. FULLER, C.B., C.B.E., D.S.O.

I ARRIVED in Massawa on October 17th, having travelled in the same ship as did Marshal Badoglio, then on a visit to the front.

Though the roadstead is good, Massawa is a third-rate oriental port, dirty, fly-blown and dusty. In spite of it then being the middle of October it was swelteringly hot, and what it must be like in midsummer does not bear thinking of. So far as I could see it was exceedingly ill provided for a great expedition. One long wharf without a single crane on it bordered its sea front; the town is nine-tenths native without a decent hotel or even a presentable saloon, and from it the communications leading southwards to Asmara are restricted to a meter-gauge mountain railway and one fair, yet exceedingly twisty motor road. Here I at once saw was the bottle-neck of the northern campaign. That on so slim a stem the Italians were later on able to hang an army of over 300,000 men certainly redounds to their credit.

From Massawa to Asmara, as the crow flies, is about seventy miles, yet the rise in altitude is from sea level to well over 7000 feet, and the change in temperature is from tropical to temperate. In fact, to those who can stand a somewhat rarified atmosphere, Asmara and most of Northern Abyssinia are a health resort, and this fact alone accounts for the slightness of sickness among the Italian troops.

Having some knowledge of mountain warfare and its needs, my first interest was the question of communications, because the supply of food and ammunition, however prosaic they may seem, is the foundation of strategy, as in its turn strategy is the foundation of tactics. But before I examine this subject I will sketch in very briefly the situation as it faced me on my arrival.

To begin with, Mussolini, from what he told me in Rome, wanted Abyssinia but he did not want a war, and failing an open-armed surrender on the part of the Negus, then the minimum of bloodshed, because his object was occupation and not plunder. He knew that the Rases were all at sixes and sevens, that revolt was latent, and he was still doubtful whether the League would be able to enforce sanctions. To gain his end the campaign opened far more as a political than as a military operation. Under General de Bono an army of some 130,000 strong was assembled in Eritrea, not so much to break down opposition as to overawe the enemy by a show of force. These tactics were eminently successful, for the Mareb was crossed on about October 1st, northern Tigré was occupied, barely a shot having been fired, and by the 10th the line Aksum-Adowa-Entishu-Adigrat was secured. Then the inevitable happened. The weight of the army in front set such a strain on the communications that, though supply did not actually break down, the advance had to be halted. Here I will turn to the question of roads.

FROM Asmara southwards run three main highways to Adowa, Entishu and Adigrat. They run through a country consisting of broad valleys cut up and separated by rugged mountains and a mixture of ambas (sugar-loaf hills) and South African kopjes and table-tops. Cultivation is sparse, aloes abound and so do cacti and thorn. In places there is jungle—in others, arid rock. At times the soil is brick red, at others white, but it is generally shaly and mud-colored. The rock is easily pulverized into dust, which generally lies inches deep upon the roads. It is an ideal country for sharp-shooter and machine gunner, and in places is well suited for tanks. For aircraft it is not so inviting, because landing grounds are few, and cover from air observation is universal.

The road I knew best, for I have travelled along it many times, is that leading from Asmara to Adigrat, and thence on to Dolo. It is well-engineered and its first lap is comparatively easy going. Part of its surface is tarred, but from Sanganetti to Adigrat it resembles the teeth of a saw set into the side of the mountain ridges. How many hair-pin bends it contains I do not know, but in thirty-one miles of it there have been counted 1700.

On such a road as this—and the other two are but a little less difficult—accidents were frequent. Not only were there many head-on collisions, but not a few lorries had the misfortune to run over the side. At one hair-pin bend I remember seeing four or five smashed to matchwood and lying in the valley a thousand feet below the spot from which they took their death plunge. How this accident actually happened was obvious: a lorry column had passed along, each machine throwing up a blinding cloud of dust; one had not seen the bend and had gone over and three or four others had followed it to destruction.

It certainly struck me so at the time and today I see no reason to revise my opinion, that General de Bono's basic problem was supply. Tactically there was nothing to stop him moving on Makale, and had he broken up his heavy corps formations into three or four mobile columns of some 10,000 men each, and held the surplus in rear, the difficulties of supply would have been vastly reduced and the advance in proportion accelerated. But this would have meant a reversion of policy, for it would have substituted military for political action. Further, his men were in no way trained for mountain warfare, and except for his Native Corps, his troops were composed of Regular conscripts and Blackshirt Militia organized for war in Europe. Again, during this early period of the war, the Italian higher command was, I think, strongly inhibited by what may be called the "Adowa complex". In 1896 Italy had suffered one of the greatest disasters in the history of colonial wars, and this disaster was very largely attributed to General Baratieri splitting his army into columns, for they were attacked in detail and almost annihilated. Were the Abyssinians today as good fighters as their predecessors of forty years ago? This was not yet known for there had been little or no fighting. As a matter of fact such a question did not arise, because, as this war was soon to show, the deciding factor was machine power and not man power, the machine gun alone having bereft the Adowa horde tactics of all value. Nevertheless, General de Bono can hardly be blamed for being cautious, for had the campaign opened with even a minor disaster, the effect on the political situation might well have been catastrophic. Maintaing his army in three corps masses, the right corps at Adowa, the central at Entishu and the left at Adigrat, the improvement of communications went on apace; the mountain roads being continually widened, their gradients eased and their surfaces improved.

MEANWHILE Marshal Badoglio, Mussolini's Chief of Staff, who had landed at Massawa on October 17th, made a complete tour of the front and the rear areas. It is possible that the pause after the occupation of Adowa-Adigrat had made the home government anxious; but I am inclined to think that the now general talk of sanctions was forcing Mussolini to consider a more drastic policy of conquest. Thus far there had been practically no fighting, and yet Abyssinian chieftains were surrendering daily; but should the League go into alliance with the Negus, and this is what sanctions meant, a tremendous stimulant would be administered to his enemy, which by raising his morale would force Mussolini to substitute military conquest for political infiltration. Further, I am strongly of opinion that fear of sanctions persuaded General de Bono to push on with his advance before his communications were ready. My reason for this is that, on October 28th, I visited a considerable section of the front, and came to the conclusion that, though Makale could at any moment be occupied by a small mobile column, a general advance was unlikely, because it could not be adequately supplied. As a matter of fact I was wrong, because on November 3rd the next forward movement was initiated. This advance was made by the left corps leading, its objectives being Makale and Dolo, whilst the central and right corps were held back in echelon. There being no fighting, the operation, in spite of an unexpected deluge of rain, was rapid, for Makale was peacefully occupied on November 8th.

Whilst during the move forward I had found the tracks abominable, on my return journey, on the 9th, I found them in many places impassable, except by pack animals and light cars. So once again it happened that the communications could not maintain the forward troops. The center and right were held back and the position of the left corps became precarious. Nevertheless, by the end of the month, troops, mainly friendly native bands, were pushed down to the Takkaze river, where they occupied the fords. Meanwhile the Tembien massif which lies south of Adowa and west of the Adowa-Makale track, having never been cleared, became a thorn in the side of the Italian main lines of communication. It was the home country of Ras Seyoum, who soon proved himself to be an able guerilla leader.

Such was the situation when, on November 18th, sanctions were imposed and the whole nature of the war was changed.

IN themselves the sanctions agreed upon at Geneva mattered very little, because the launching of the war itself had all but bereft the lire of its purchasing power. Yet from the point of view of the war their influence was decisive, for by stimulating the Negus they exasperated Mussolini. No longer was it now possible to rely on a slow penertation of the country; instead action was demanded even if of a ruthless kind; for were sanctions to be extended to oil, or were the Suez Canal to be closed, as was daily demanded in the British press, the war must collapse and with it in all likelihood the entire Fascist régime. In short, the economic blockade not only compelled Mussolini to fight for the conquest of Abyssinia but for his political existence in Italy.

His immediate answer was to recall de Bono, the politically minded general and replace him by Marshal Badoglio the professionally minded soldier, who landed at Massawa on November 28th and forthwith took over command.

The problem which faced him was as difficult as any commander-in-chief could be confronted with. He found an army of some 200,000 men more or less distributed as a political demonstration on a front of about 300 miles with its rear communications incomplete and skirting the western and eastern margins of the Tembien massif. He also found himself faced by an enemy enthused by the League's action. If he withdrew his right wing, which was dangerously situated, he exposed himself to a *levée en masse* of the whole country south of him, for any sign of weakness on his part would have been taken immediate advantage of. Again, if he held on, he risked local defeats, which would at once be magnified by the Abyssinians into major disasters. Further, it was obvious to him, for he told me so himself, that he could not advance until his communications had been greatly improved and large numbers of pack animals collected. Yet there can be little doubt that he there and then decided to turn the political attack into a great military offensive operation. Therefore, in order to cover his pause, which was destined to last for over six weeks, he did two things: First he ordered the fortification of his front, and loose stone forts were constructed on every height and then linked together by machine-gun posts. Secondly, he instituted so rigorous a press censorship that he drove ninety per cent of the foreign journalists out of the country. Shortly after the war opened there were some seventy in Asmara, and by the middle of January less than ten.

Here I think he made a mistake. It is true that under General de Bono we journalists were given a very free hand. As it happened this fitted policy, for as the war was blood-

less, we were for the most part reduced to reporting upon the pacific occupation of the country and such like subjects. Nevertheless, there can be little doubt that this generous treatment was, from the Italian point of view, reacting very favorably, for journalists readily responded to it, and in consequence world public opinion began to follow suit. Under Badoglio this policy was completely reversed, instructions being issued that no mention was to be made of the names of commanders, of localities and of units, and that on no account were movements of either Italian or Abyssinian forces to be referred to. The result was that journalist after journalist packed up and left, none too well disposed to the Italian cause. What the Marshal did not seem to realize was that it was of very great importance to him and his government to weaken the League, and that the quickest way of doing so was to win over world opinion if only in part.

HAVING covered himself against attack and criticism, he set to work to prepare for a campaign, which was to be as ruthless as de Bono's had been considerate. First he ordered General Biroli, in command of the Native Corps, to clear the Tembien, where Ras Seyoum was causing considerable trouble. Secondly, he reversed the policy of allowing the civil inhabitants to retain their rifles, as it had been found that many of them were supporting that guerilla chieftain. Thirdly, he restricted the promiscuous bombing of Abyssinian columns and concentrations, because it was sound tactics to let the enemy mass. The one thing he very rightly feared was that they might cease to do so, might distribute themselves in small easily feedable groups throughout the country and start a guerilla war, for which the bulk of his army was ill-prepared. In fact, had he been faced by Pathan tactics, his army would have been in a most critical position.

From these actions it became clearly apparent to me that he was seeking battle on an extensive scale, and so convinced was I of this that, as early as December 5th, I wrote: "In spite of the meagerness of information during the last few days and perhaps on account of it, it would seem that the Tigrean air is becoming charged with electricity and that a storm is approaching. . . . ." Thus far the Negus had been able to hold his northern Rases in hand; but from reports then being received from Addis Ababa it appeared that certain of them were straining at the leash, and that at any moment it might break. I then pointed out that on the Italian side the campaign had now reached a stage when it was no longer possible to advance in a Great Wall of China formation. I wrote:

"South of the rivers Takkaze and Gheva, without Herculean labors, it is no longer possible to advance three corps of some 120,000 men in line; therefore a tactical turning-point has been reached. . . . . To me it seems that a radical change is imperative and that it is possible that out of the present united advance of the Northern Army, two separate campaigns will be developed: one corps operating towards Gondar and one on Amba Alagi, whilst the third holds the Makale-Dolo position as a base for these corps to operate from. This is the situation as I see it: The Negus, because of the lack of discipline among his Rases, is being pushed towards seeking a successful battle, and the Italians, because of the application of sanctions and changes in topography, are being forced away from what may be called 'overawing tactics' towards more normal operations of war. . . . ."

I was given to understand that the Marshal expected an attack on his left flank. This I could not believe, because this flank was strongly fortified, and though as tacticians the Abyssinians are capable of almost any folly, I really could not see why they should run their heads against a brick wall when the greater part of their enemy's right flank lay open to them.

This flank rested on the Takkaze, and was, as I have described, held by detached posts, and was over-extended. Time and again I asked to visit this front, but was refused; for, from December 10th onwards all foreign journalists were literally interned in Asmara, not being even permitted to leave the precincts of that town.

WHILST this smoke cloud was being emitted, General Biroli cleared the Tembien; yet barely had he done so when a rumor reached the press office at Asmara that a considerable engagement had been fought on the Takkaze river near Mai Tinchet; that the Abyssinian forces were under Ras Immiru, who had been reported advancing through the Province of Uoghera (northeast of Gondar) on December 5th. The next day we learned that he was in command of 3000 warriors; that he had advanced in two columns and had forced an Italian detachment of about 1000 strong back from the Takkaze, and had cut it to pieces in the pass of Dembeguina. Then, on the 19th, we were informed that the battle had opened on the 15th, was concluded on the 17th and that the casualties were as follows: more than 500 Abyssinians killed; Italian losses, 7 white officers and 20 white privates killed, also 48 native cadets and 197 native privates killed, the wounded being as follows: 2 white officers, 2 white privates and 25 natives. In other words 272 killed and 29 wounded which suggested massacre.

The result of this small engagement was extraordinary; for now that Marshal Badoglio had secured himself against press criticism, few things in actual fact could have been more advantageous to him, because his policy, in contradistinction to General de Bono's, was to seek and not to avoid battle. So long as his phalangial order held firm, battle was almost impossible; but now that it was broken, this setback intoxicated the Abyssinians and filled them with an offensive ardor. As they poured into the Tembien, the whole of the Italian right wing had to be withdrawn to a little south of the Adowa-Aksum track, that is to the position it had held before the advance on Makale began. This resulted in the Italian front assuming the shape of the letter Z, and in consequence it was automatically split into two main groups, namely the Aksum-Adowa and the Makale-Dolo, connected by the Adowa-Makale, Entishu-Hausien and Adigrat-Dolo roads.

No sooner had the Abyssinians gained this small success than a force of 5000 of them was reported to be massing in the neighborhood of Abbi Addi and Enda Mariam Quarar in the Tembien, twenty-five miles west of Makale. There on the 22nd and 23rd a battle was fought between 7000 Abyssinians and 4000 Italians, the official casualties being as follows: Abyssinians, 700 killed and 2000 wounded; Italians, 173 killed and 167 wounded. Again these casualties are irreconcilable with normal statistics; yet, as given, what they do show, is the extreme desire for battle on the part of the Italian higher command, not only in order to impress Geneva but to blood their own troops.

Here I will pause in my narrative of the operations, and

turn to the tactics of both sides; because, unless the reader has some slight knowledge of how each fought, it will be extremely difficult for him clearly to appreciate what follows.

First it must be realized that all soldiers, whether belonging to civilized or barbaric states, are closely circumscribed by tactical traditions. That is to say, they follow the technique developed during past successes rather than elaborate a new one based on the powers of the weapons they are actually armed with. Like all other European armies, the Italian was saturated with what may be called the "bayonet tradition", whilst in their turn the Abyssinians were obsessed by the "spear tradition". Both are very similar, for both to prove effective demand masses of men, and yet in a mountainous country it is obvious that masses are suicidal when projectile-throwing arms are used.

NOW, from the very start of the war it should have been obvious to the Italian General Staff that the massing of the enemy was tactically the one thing to be desired, because the forces controlled by them being incomparably better equipped with projectile throwers—machine guns, cannon, tanks and airplanes—the more their enemy massed the greater would be his defeat. It is no exaggeration to suggest that a force of 5000 Italians, so long as its men were trained for mountain warfare and well supplied, could almost in any circumstances easily defeat if not annihilate 50,000 Abyssinians. Equally important, it stands to reason that the smaller the forces used the more likely were the Abyssinians to mass against them. In fact, their smallness would be the bait and their weapon power the hook hidden within it.

It was for this reason that, immediately after the outbreak of the war, I could not understand why instead of advancing a number of mobile columns on a wide front, one great phalanx was used. I could not understand this because I did not then realize the political nature of the northern campaign, or that the troops employed in it were totally untrained for mountain warfare.

This lack of training not only forced the Italians to maintain a massed order of advance, but for a long time it detrimentally affected their air tactics; because, as the Abyssinians were totally unable to attack the masses, the Italian aircraft had to act independently: that is to say, without reference to ground action, to seek out the enemy masses and bomb them. This could and did result only in breaking up the enemy and at so great a distance from the front that no ground action could follow.

Quite early in the war this lack of coördination struck me forcibly, and I arrived at the following conclusions: "Aircraft have two main functions, namely, reconnaissance and attack, and as the Abyssinian air force is not worth considering, attack in this theatre of war is against targets and forces on the ground.

"The effectiveness of these two duties lies in inverse ratio to size of area and objective. Thus, the larger the theatre of war the more difficult becomes the first, and the smaller the target the more difficult is the second. Further, as regards the former, work is complicated by the fact that over half of Abyssinia is a mountainous country, in which the province of Tigré is entirely so; consequently this country offers few landing grounds, and the air reading of the ground is obviously more difficult among mountains than on the plains. In such areas masses of men must be large to be seen. Also the indented nature of the ground enables them almost instantaneously to volatilize. They can scatter, hide and reassemble. In fact, during a week, the same force may be reported as a different force in half a dozen places, and in consequence completely confuse intelligence, and through intelligence, planning. Personally, in such regions, I would put little trust in air reconnaissance unless it immediately preceded action or battle.

"Now as to attack. This problem centers round the question, when and where to strike at a target? And the answer is to be sought in examining three well-known factors, namely: (1) The marked effect of air bombing on concentrated human targets, such as men in mass or men retiring through a defile. (2) The insignificant effect of bombardment of large areas. (3) The demoralizing effect of (1), and how rapidly human nature accommodates itself to (2).

"Therefore, I am of opinion that (2) should be sedulously avoided, and that (1) should be resorted to only when battle is imminent or engaged.

"WITH these facts in mind, I will turn to the operations in Tigré. As the reader will realize by now, the weakest link in the Negus' harness is the lack of an organized commissariat; consequently when his troops are concentrated, whole areas are devastated by foraging. Now, to let and even to encourage the enemy to waste his land, may be of the greatest tactical value; therefore indiscriminate bombing of every concentration shows a lack of tactical cunning. Personally, in a war like this one, a contest between organized and partially organized forces, so long as I commanded the former, I should welcome my enemy massing. Therefore, before a battle opened, I should allow very little bombing. I should look upon my airplanes as light and heavy cavalry, the duty of the first being reconnaissance and of the second the bombing charge.

"The light would go out to discover and report upon the enemy, and once discovered, in place of sending out the heavy to collect glory, I would hold them in hand. Next I would attempt to maneuver my army in a way which would draw the enemy into an unsound tactical position, such as with his line of retreat running through a defile. Then I would egg him on; fall back and persuade him to mass his men. This done, I would stiffen up my front and hold him, and lastly launch on his rear my aërial charge. Once broken and compelled to retire, a pursuit of every available machine would be made."

I do not think that the Italian higher command fully appreciated these tactics, anyhow during the first three months of the war, and that it was not until the Abyssinians played into their hands they set them in motion. Even if this is so, it redounds to the wisdom of this command that eventually they put them into operation with such decisive effect.

Turning now to the Abyssinians, what do we see? An arrogant people whose easy victories of forty years before had endowed them with a fighting reputation which was not really theirs; or else a reputation which, under more modern conditions, they were unable to live up to. "Since 1895-1896," I wrote on November 23rd, "so I feel, the natural warriors of the hills and the plains have been contaminated by European military ideas, and are now more than less half-baked fighters. Though, as regular armies go, the Emperor's professional army may be efficient, in my opinion it has weakened rather than strengthened his fighting power; because in such a country as this and with the people who

inhabit it, true military power depends, not upon drillmastership, but upon planned irregular individual and band action.

"Should the Abyssinians wake up to the supreme fact that defense lies in the individual fighting man and not in the drilled mass, or for aught that in any mass, then woe to the Italian forces as at present trained and organized. Such of our own soldiers who have fought on the Northwest Frontier of India will understand this clearly: Picture an army of nearly a quarter of a million men, neither organized nor trained for this warfare, slowly creeping through a mountainous country many times the size of the Frontier, an army with communications stretching mile after mile in rear of it, and then introduce into this picture 50,000 Pathans split up into 200 fighting bands, always striking at weakness and never at strength, what will the success of that army be? . . . .

"Fighting in their own country, their power to glean information is universal, for every fellow countryman and countrywoman is an ally. They know exactly where their enemy is, what he is doing, how he is situated, what he has got and what he lacks. Their handicap does not lie in their somewhat obsolete armament; because for the tactics which should be theirs, all they require is a good rifle and not necessarily a modern one, but in the deficiency of a supply organization. In this respect they are so badly furnished that, instead of acting in independent groups . . . . they mass in the fertile valleys and on the cultivated plains and so elaborate horde instead of group tactics. In either case they are come-and-go riflemen, and in consequence lack discipline and staying power."

With this picture in mind I will now return to the operations.

AS I have hinted, the breaking of the Italian front on the Takkaze was a blessing in disguise. First it broke the phalangial order and forced Marshal Badoglio to think in terms of columns; secondly, it provided him with an excuse to tighten up his policy towards the civil inhabitants, many of whom had joined Ras Seyoum; thirdly, it intoxicated the Abyssinians into believing that they had their enemy on the run and that a second Adowa awaited their arms.

It is indeed strange how the shadow of this battle of forty years before influenced the strategy and tactics of this war. On both sides it induced the massing of men; on the Italian to prevent its recurrence and on the Abyssinian to effect it, and it was not until the latter had definitely proved that massing was a fatal mistake that the Italians began to shake their slow-moving phalanx out into self-contained mobile columns, which were far easier to supply, as their pack animals could subsist on local foraging.

Whether Marshal Badoglio had in his head a set scheme as to how he intended to conduct the war, I do not know; but what he did between his arrival and the middle of December leads one to suppose that he meant to carry on the advance in massed formations, striking the main blow with the left wing of his army.

During these six weeks the whole of his Z-shaped front was strongly fortified, and his left reinforced by a vast quantity of guns of all calibers from six-inch downwards. Meanwhile reinforcements were poured into Eritrea, the army being doubled in man power. Above all things he wanted a big battle, and the fulfillment of this want depended not on him, but upon whether his enemy would commit the egregious blunder of attacking him in force. If they did he knew that he could annihilate them; if they did not, then he was faced by a guerilla war, for which his army was neither organized nor trained, which might easily anchor him to his position for months.

Meanwhile Ras Seyoum and Ras Kassa, sheltered in the fastnesses of the Tembien, daily and nightly raided the Italian communications and actually crossed the Mareb and advanced to within rifle shot of Adi Quala. Lorries were shot up, posts cut to pieces and the communications thoroughly terrorized. So nervous did the Italian rear services become that from Christmas onwards, nightly shots were heard in Asmara and several unfortunate civilian natives were killed by nervous sentries and road patrols. All the Abyssinians had now to do was to augment these guerilla exploits. At any time they could have overrun Western Eritrea and spread panic as far as Tesseney and Barentu. They did nothing of the sort. Instead, each minor success raised their conceit and brought them nearer and nearer to the brink of disaster.

DURING the first fortnight in the new year both sides were rapidly increasing in numbers, and, as we now know, both were preparing for battle: the Italian to free their communications, and the Abyssinian, so it would seem, merely to show off their prowess. When the clash came, as it did on January 19th, it is not possible to say what actually happened; for according to Marshal Badoglio's communiqué it was a complete victory. He says: that whilst Ras Kassa and Ras Seyoum, based on the Southern Tembien, were preparing to attack the Italian "lines of operation" between Makale and Hauzien, they were attacked by the Third Army Corps and halted. Then, on the 22nd, the 2nd Blackshirt Division held up the enemy's main body near Abbi Addi and defeated it on the following day. During this fighting it was claimed that over 5000 Abyssinians were killed, whilst the Italian losses in killed and wounded numbered 743. On the other hand, according to the communiqué issued by the Negus, though the Italians opened the attack, their army was driven back and "pursued to destruction". He claimed as booty 29 guns, 175 machine guns and 2654 rifles, as well as convoys of ammunition, mules and many prisoners.

Though at present no definite conclusion can be arrived at, it would appear that this battle was a drawn one, and for the following reasons: First, the Tembien was not cleared; secondly, the journalists on their way from Asmara to the front, were, on arriving at Adigrat, suddenly turned back as the country was not safe for them to proceed through; thirdly, the Abyssinians killed, unless whole groups were massacred in cold blood, is obviously a political figure. Five thousand killed means at least 25,000 wounded, that is 30,000 in all, omitting prisoners and missing, or half the British casualties on the first day of the Battle of the Somme. As in battles, even of the most desperate kind, casualties seldom exceed twenty per cent of effectives, 30,000 means that the total Abyssinian forces in this battle must have numbered some 150,000 men. Such figures for the Tembien are simply fantastic; for this district had been foraged over again and again.

Meanwhile an extremely interesting operation had taken place in Italian Somaliland. It will be remembered that,

when the war opened, my opinion was that the main operations should have been directed against the railway and not southwards through Tigré. And now that the war appears to be approaching its end, I see no reason to change this opinion. What prevented it seems to have been that from the start General Graziani's operation was looked upon entirely as a subsidiary one; that the climate did not allow of a concentration of European troops, and that the supply of native troops was limited and none too reliable. Further, Mogadishu was an indifferent post for a large army, and the communications leading towards Harar were difficult to protect.

I REMEMBER quite early in the war thinking out this problem, and though I had few facts to guide me, I came to the conclusion that in Ogaden as in Tigré the fundamental problem was the maintenance and protection of communications. As the main line of advance roughly followed the Shebeli River, and as its right flank was fairly well covered by British Somaliland, any threat to the communications was obviously more likely to come from the west than from the east. I, therefore, expected to see a flanking force based on Dolo and Jet operating northwards to threaten the right flank of any Abyssinian forces attempting to cut Graziani's communications. Also I expected him to run a block-house line along the western margin of his Shebeli line of advance, which would have afforded it strong local protection. What he did and how his forces were organized and distributed I have no idea; for all I know is that early in the war he occupied Gorrahai, and that, on my return from Makale, on November 10th, I heard that he had advanced to Daggabur. A few days later I learned that this was but one of his famous Lybia tip-and-run operations—a raid which, so far as I could see, was of no strategic value.

Nothing further was heard of him, when suddenly, on January 12th, a great Italian victory was reported nearby Dolo on the Juba River, some 400 miles south of Harar and close to the Kenya border. There, on the 12th and the succeeding days, Ras Desta was heavily defeated in a battle called after an affluent of the Juba—Canale Doria, and driven in rout beyond Negelli. As it had now become normal procedure in the Italian official communiqués, 5000 Abyssinians were stated to have been killed, another 5000 being added to this figure on the 27th.

This battle was an exceedingly important one; yet its true meaning escaped public notice, and certainly was not appreciated by the Negus. For over three months, General Graziani had been toiling with his Harar operation, now he and presumably a considerable part of his main army had been pulled several hundred miles away in the opposite direction; consequently, though he had gained a tactical victory he had simultaneously suffered a severe strategical defeat.

As I have pointed out, ever since the opening of the war his objectives had been Harar, the Jibuti railway and the Barbera road; now for weeks he would be forced to abandon them. Obviously what had happened was this: it was not so much the rains that had held him up as the persistent Abyssinian threat against the southern flank of his lines of communication, and to clear these he had been compelled to move south. Put slightly differently, as the northern political campaign under General de Bono had been disrupted by the economic blockade, the southern had been upset by a somewhat similar maneuver.

The situation the Negus now found himself in was by no means a desperate one. In the north, though his Rases had attempted a large-scale attack, they had gained some success and were still masters of the Tembien. All they need do now was to restart their guerilla war, and avoiding pitched battles aim their attacks at their enemy's lines of communication. In the south, though Ras Desta's army had been scattered, strategically Graziani was faced by a dilemma: either he could follow up his enemy or abandon the advance and return to the Harar operation. As a matter of fact, on account of the nature of the country northwards of Negelli and the difficulty of protecting his new line of advance, strategy dictated that he should turn towards Harar, and to restart his initial operation would take him several weeks.

Partially bunkered in the north and delayed in the south, it seemed certainly to myself that the Italian hope of finishing the military phase of the war before the monsoon broke in June was a slim one. Yet in war it is the unexpected which so often happens, and as I will now show the insensate foolishness of the Negus and his Rases presented victory to their enemy.

WHILST Marshal Badoglio was preparing for a set-piece battle, Ras Mulugeta, the Negus' leading general, at the head of an army which had in greater part been trained and equipped on European lines, in place of breaking away and extending the guerilla war, perpetrated the egregious blunder of massing against Makale and so offering his opponent a target to strike at. This was to play directly into the Marshal's hands; for had he not done so the vast preparations made would have been completely wasted.

Leaving him alone and fully realizing that if he could destroy the Negus, who had now established his headquarters at Dessye, he would knock the hub out of the Abyssinian wheel, the Marshal concentrated his bombing attack on that place as well as on the rear of his forces' immediate enemy. Then, suddenly, on February 11th, completely surprising the incompetent Mulugeta, he struck at him in the area which lies south of Shelikot and north of Antalo. This engagement, which lasted until the 16th and became known as the battle of Amba-Aradam or Enderta, was decisive in that it forced a general retirement through narrow defiles, and so presented to the Italian air force an ideal target to strike at. During it, no less than 174 tons of bombs were dropped on the shattered horde, which was driven southwards in panic. In this battle the Italian casualties were 188 killed and 599 wounded, which are probably correct, the Abyssinian being reported to be 5000 killed as usual.

Whilst the broken enemy was being pursued, the Italian left wing advanced some twenty miles south of Amba Adaram and occupied Gaela, which lies on the Abbi Addi-Sokota track. Whereupon Ras Seyoum and Ras Kassa, in place of withdrawing westward, for this occupation threatened their southern line of retreat, committed the folly of moving eastwards. Once again this was to play into Italian hands, for the advance southwards on Amba Alaji could not, without considerable risks, be made until the Tembien was cleared, and had these two Rases moved westwards it would have been most difficult to do so. Realizing the mistake his enemy had made, Marshal Badoglio at once pushed on to Amba Alaji, which he peacefully occupied on February 28th. Simultaneously he advaned on Abbi Addi, one column moving against it southwards from the Abaro pass and another northwards from Gaela. There, on the 27th, he attacked

them, almost completely hemming them in with his gunfire. The result was the defeat of his enemy. Concerning this battle he commented in his communiqué: "The enemy has suffered such a defeat as to have lost any readiness to fight—a thing unheard of in the military history of Abyssinia." The truth is that mainly on account of air attack the Abyssinian morale was fast being destroyed.

NO sooner was this battle ended than two Italian columns, again one moving from the north and the other from the south, struck at Ras Imru, reported to be in command of 25,000 warriors. From near Dembeguina he was driven in rout towards the Takkaze. In this battle, as in its predecessors, air bombarding and machine gunning were so intense that the enemy's forces were fragmented and lost all cohesion.

At the time I was interested to learn that during these battles an increasing use was made of mustard gas. Not to terrorize the villages or directly to inflict casualties; but, instead, in order to protect the flanks of the columns as they advanced through the defiles of the Tembien. In other words, to shield them from guerilla attack. Though this is not mentioned in the Italian reports, the following extract from one of Marshal Badoglio's communiqués shows how rapidly weapon power was influencing traditional tactics:

"For the first time in colonial military history numerous large units have been set in motion simultaneously with impressive masses of mechanized artillery of small and medium caliber and of light tanks, while the sky has been crossed by swarms of airplanes. All these complex movements have been regularly carried out, overcoming difficulties which might have seemed insuperable. The Third Corps moved into the Gaela zone across rugged and difficult ground, constructing as the march proceeded a motor track 50 miles long. Daily there were transported thousands of tons of material of all kinds, and supplies were twice carried by air for an entire army corps. Several groups of artillery of medium caliber, drawn by heavy tractors, covered over 300 miles, making daily stages of 90 miles, in part over tracks made during the action. From Massawa to the zone of operations, 1500 mules were carried by motor transport in two days alone. For communications during the battle over 800 wireless stations were set up."

The truth is, as I have said, machine power was now daily compelling the breaking up of the original phalangial order into mobile columns, and that dearth of training in the protective duties of mountain warfare was more than made good by the use of mustard gas. In place of the laborious process of picketing the heights, the heights sprayed with gas were rendered unoccupiable by the enemy, save at the gravest risk. It was an exceedingly cunning use of this chemical.

Considering the nature of the country and the immense difficulties in supplying either concentrated or scattered forces of men, the shaking out into column formation was accomplished with remarkable rapidity; for on March 7th all columns were on the move: the left, composed of the First and the Native Corps, towards Lake Ashangi; the Third from Gaela towards Fenaro; the Second on the Aksum-Gondar track; whilst a detached force was advancing from Om Ager on the Sudan frontier towards Noggara. Meanwhile the Fourth Corps began occupying the Semien mountains, several of their peaks rising over 14,000 feet. As these movements were taking place, in the south General Graziani re-commenced his activities against Harar; Jijiga was bombed again and again, and on the 29th after due warning the greater part of Harar was reduced to ashes.

The last day in March and the first two days in April witnessed the most astonishing events, the first of which was in its way decisive. The Negus, be it remembered, was not only the head of his government, he was the government itself. It was for this reason that, for several weeks now, Italian aircraft had been hunting him in order to knock the hub, as I have called it, out of the Abyssinian wheel. So long as he remained alive, or his prestige held firm, there was every reason to expect that the war would continue; consequently it was of vital importance to him to maintain his prestige. Yet this is what he now failed to do, and in a way which was to prove suicidal.

Greatly perturbed by the Italian victories, he moved his headquarters to Kworam, and from there, at the head of his small regular army supported by the fragments of the forces of Ras Kassa and Ras Seyoum, on March 31st he launched an attack on the head of the Italian left wing at Mia Chio. Supporting his troops by artillery and trench-mortar fire, at first he seems to have gained some minor successes. Then the inevitable happened. Held and decimated in front by shell and machine-gun fire, he was counter-attacked by aircraft, seventy machines dropping thirteen tons of bombs upon his men. Pulverized by high explosives, they broke back, were followed up, and, on April 3rd, were completely scattered in the battle of Lake Ashangi, where the now disorganized masses were bombed and machine-gunned by 140 airplanes. In this battle the Italians claimed that their opponent suffered, 20,000 casualties of which 7000 were killed.

Simultaneously with this victory came the news that an Italian motorized column had advanced from Assab on the Red Sea, and after a march of sixteen days across 220 miles of the Danakil Desert had occupied Sardo. Bombing machines were supplying it and further still were being used as troop carriers, conveying eight armed men on each flight. Meanwhile a somewhat similarly organized column, some 3000 strong, was detached from the Second Corps, and in twelve days it advanced 186 miles and occupied Gondar.

ALWAYS bearing in mind the nature of the country, the war now enters what I believe will eventually be considered to be its most remarkable phase. Difficult as it has always been to win battles in a mountainous region, hitherto rapid pursuits in such have been far more difficult still. Yet in this war the reverse is to be seen, battles are overwhelming and pursuits speedy beyond belief. The reason for this is twofold: first, because the Abyssinians substituted mass tactics for guerilla warfare, and secondly because air attack and pursuit are almost as easy in a mountainous area as over desert or plain land.

First, it was the folly of the Abyssinian tactics which rendered the Italian victories possible, by offering targets to air attack. Secondly, it was aircraft which rendered pursuit effective, and how effective may be judged from one small incident, namely, a propaganda flight on April 14th of twenty-two Italian machines to Addis Ababa and back; when in seven hours they covered 700 miles. Compare this to the power of cavalry in the past. Even in open country, let alone roadless and mountainous, pursuits have seldom exceeded twenty-five miles in twenty-four hours, and then have generally petered out in a few days. In this war there is nothing to prevent them being continuous, and 700 miles in seven

hours compared to 25 in twenty-four hours is a difference of 100 to 1. In other words, aircraft have speeded up the pursuit 100 times. Thirdly, it was man power which rendered the maintenance of the pursuit possible—man power in administrative and not in combatant form. On the date just mentioned, Marshal Badoglio reported that in the northern theatre of war he was employing 170,000 men on the roads, and of these 120,000 were soldiers. As the front was thinned out and the rear was thickened up with men, the more speedy became the advance; because, though the airplane opened the way, it was the lorry which supplied it, and the lorry was the fourth and, so to say, the basic factor in the pursuit.

For a moment I will turn to it during the fortnight following the victory of Lake Ashangi. On April 5th Kworam was entered under cover of sixty-four tons of bombs. On the 6th the advance was pushed on to Alomato, and two days later the road south was opened as far as Mia Chio. On the 10th Kobbo was sighted and on the 12th entered, the leading troops being supplied by aircraft. This day the Galla tribesmen joined hands with the Italians and Marshal Badoglio issued his proclamation abolishing slavery. Then, on the 15th, Dessye was occupied, a pursuit of 120 miles having been accomplished in nine days. Meanwhile, on the 13th, Lake Tana was reached by the leading troops of the Second Corps; the Abyssinian customs post opposite Gallabat in the Sudan was occupied by a motorized and mechanized column, and the day following, troops of the Third Corps reached Mount Abuna Josef on the Socota-Magdala track. Without fear of contradiction, I think it may be said that nothing like this pursuit has ever before been witnessed in mountain warfare.

Of these several advances, that on Dessye was the more spectacular. During it its van did not consist of motorized forces, as the ground was impracticable for vehicles. Instead, the Native Corps, also called the Eritrean Army Corps, 20,000 strong, was advanced from Kworam on April 9th, and during its six days' march of 120 miles it was entirely provisioned by squadrons of airplanes. It was followed by a supply column of over 9000 mules and camels, also partially provisioned by air, 120 tons being dropped, in rear of which tens of thousands of men were working on the roads. The combination of supply aircraft, pack animals and lorries was the foundation of this advance, and tactically the terror already caused by mustard gas undoubtedly speeded it up.

With the occupation of Dessye it is of interest to pause and look at the general situation of the various Italian columns. They take the form of an immense semicircle, stretching from Gallabat to Lake Tana, to Abuna Josef, to Dessye, to Sardo, to Gabridihari (south of Sassa Baneh), to Imi and finally to the upper reaches of the Canale Doria. That is, as the crow flies, a semicircle of no less than 1300 miles in extent. Accepting 200 to 250 miles as the average radius of action of the Italian bombing machines, then from this semicircle, except for the extreme west of Abyssinia, any portion of the country still unoccupied falls within the area of air bombardment, which as the columns contract on the center can become more and more intense. What does this really mean? Not the economical blockade of the inhabitants and forces within it, but their moral blockade—the starvation of their nerve power. Looked at slightly differently, each column of troops, whether motorized or not, is little more than a base for air action; as it were the protective guards of a series of airdromes, the forward movement of which depends upon the speed at which the ground forces can maneuver. In other words, if the airdromes are compared to cannon and their airplanes to flying shells, then the troops on the ground are nothing more than an escort to the guns.

Bearing this picture in mind, the reader will at once realize the importance of Harar. Outside any question of it being the second city in Abyssinia and the Negus' natal town, in the present encirclement, the weak link in the semicircle lies between Sardo and General Graziani's forces south of Sassa Baneh. This is undoubtedly one reason why, as I am writing, the advance on Harar is being vigorously pushed.

Here, Graziani, a general of considerably repute, seems to have had to face greater difficulties than the generals of the northern columns. Not only is the climate nothing like so favorable, but on account of the rains his advance has been time and again impeded. All said and done, mountains are made of rock; consequently, once a road is hewn, the rain will not affect it in the same degree as roads built in the plain lands. Though Graziani has been employing 30,000 men on road work, his progress has been slow, because stone has frequently to be transported many miles. In spite of this difficulty and the bushland which makes air observation in places impossible, on April 14th he attacked his enemy on the Giana Gobo, an affluent of the Fofan River, lying sixty miles west of Gabridihari. There he fought a battle on the 15th, 16th and 17th, and by flank attacks "constantly supported by waves of airplanes" broke up the Abyssinian forces, killing as he reported 3000 men. As I write, he is closing on Sassa Baneh and Badoglio's advance from Dessye on Addis Ababa has begun.

How this war will end it is impossible to say; but there can be little doubt that, long before these words appear in print, Addis Ababa, Harar and Dire Dawa on the railway will be occupied. What will happen then is on the lap of the gods, and whether the war is to continue, collapse or enter a police phase must be decided by these occult powers. Yet, whatever takes place, this war will be looked back upon as one of the most remarkable ever fought. Not only does it show beyond dispute the enormous influence of modern weapon power in such undertakings, but also it demonstrates clearly enough the changing nature of war between civilized nations. It is true that, in such wars, armaments are far more equal; yet it is also true that in them aircraft targets are far more abundant, because the population is more dense. If it is possible by means of chemical and high explosive bombs to demoralize the tribesmen of a mountainous region, how much more possible is it to demoralize the inhabitants in the overcrowded cities and industrial areas of the great civilized powers. Again, it may well be asked, what place have the old arms in battle when confronted by the new? Had the Negus been supported by a vast army of European cavalry, infantry and horse-drawn artillery, would he have been much better off? In many ways he would have been far worse off; because he would have had more mouths to feed and the air targets would have grown larger. What does this then lead us to suppose? That in another European war the decisive weapon will be the airplane, and when it has defeated or mastered its like, the masses below are at its mercy, and that the larger they are, not only the more vulnerable will they become, but the greater will be the social upheaval following their catastrophe.

Perpetuating Our Military Past

Battle Areas, Records and Maps Preserved by the Park Service

By Verne E. Chatelain*

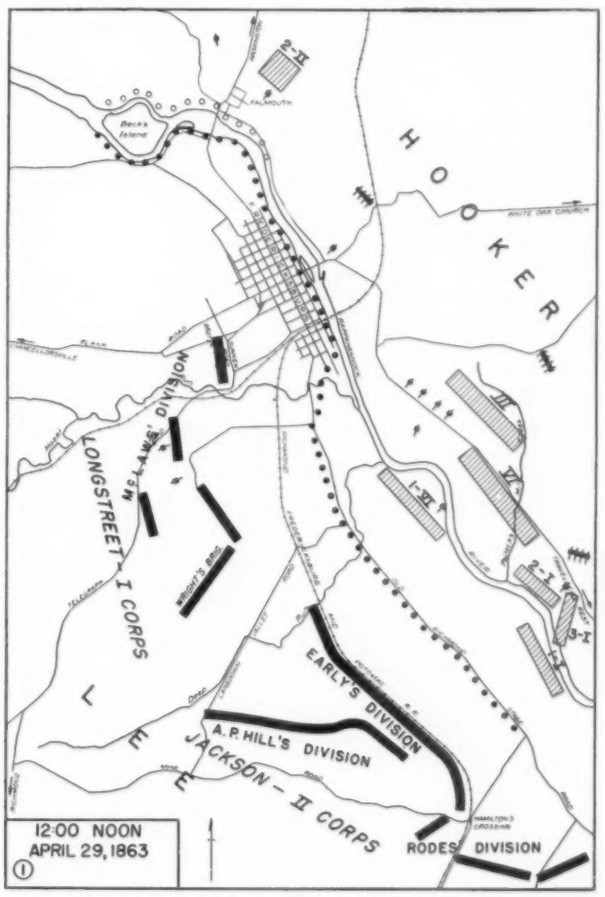
THE national battlefield areas, created by Congress from time to time and designated by a variety of names, such as national military park, national battlefield park or site, and even in some cases national monument, have been set aside as monuments to those citizens who fought to found or preserve the Nation. But their significance is more than this. They help the visitor to study important historical events on the ground where they took place, and to re-create in his mind the whole historical situation.

Some realization of this fact is evidenced in various enactments of Congress directing those charged with the duty of preserving these battlefields ". . . . . to survey, locate, and preserve the lines of the opposing armies in said battles, to open, construct, and repair such roads, highways, paths, and other approaches as may be necessary to make the historical points accessible to the public and to students of said battles . . . . to ascertain and mark with historical monuments, markers, tablets, or otherwise, ... all breastworks, earthworks, gun emplacements, walls, or other defenses or shelters, lines of battle, locations of troops, buildings, and other historical points of interest within the park or in its vicinity . . . ." (U. S. Code, Title 16, 425 d) also ". . . . . to carefully study the available records and historical data with respect to the location and movement of all troops which engaged in the battle . . . . . and the important events connected therewith, with a view of preserving and marking such fields for historical and professional military study." U. S. Code, (Title 16, 426, 428 b).

Judging from the language of these Acts, it is clear that Congress contemplated something more than the placing of markers on the battlefields for the information of the casual tourist. You will notice that the law directs that the historical points be made accessible "to the public and to students of said battles . . ."; it further directs a careful study of "the available records and historical data with respect to the location and movement of all troops which engaged in the 'particular battle', with a view of preserving and marking such field for historical and professional study."

The national battlefields were formerly under the jurisdiction of the War Department, but by Executive Order dated June 10, 1933, as interpreted by Executive Order dated July 28, 1933, the administration of these areas was transferred to the National Park Service of the Department of the Interior. Since the creation by Congress in 1916 of the National Park Service, its program has been concerned to a considerable extent with the preservation of the Nation's historical areas "by means of which . . . . the story of prehistoric, the colonial and Revolutionary periods, as well as those dealing with the formation of the nation . . . ." is told. "These areas typify the progressive story of American History . . . . Taken collectively, these historic sites suggest the magnificent sweep of American growth. Individually, they assist the student in his examination of the ground where history has been made, by supplying valuable source materials; and also they interest the average man, whose understanding of things American will be broadened and deepened by visiting the areas which suggest thus tangibly the important patterns and themes of our national development."

THE essential problem of the student of a military campaign is to combine effectively a study of written records of all kinds, but especially official records, with a minute examination of the terrain itself. Regarding the written records of the Civil War campaigns, it should be noted that at the conclusion of each campaign, the various commanders filed reports of the operations of their respective organizations. These reports, including the maps which sometimes accompanied them, together with the correspondence and dispatches, constitute the official records of the campaign. There are many other important written sources which must be used in a study of a Civil War campaign, including original accounts of the war found in contemporary newspapers and magazines, as well as similar material written after the war. Such materials are to be found in the Southern Historical Society Papers, the Papers of the Military Historical Society of Massachusetts, Battles and Leaders of the Civil War, the War Papers of the Military Order of the Loyal Legion of the



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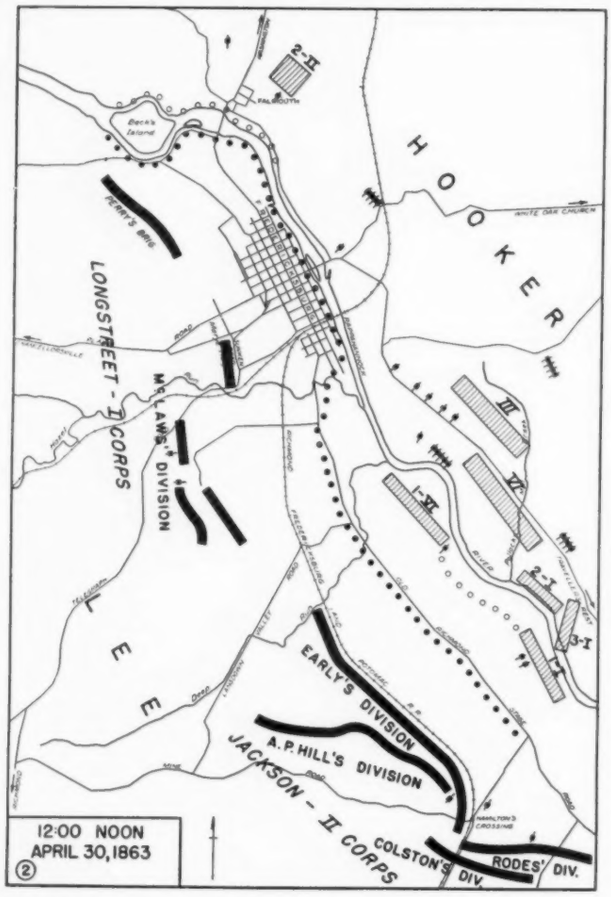
United States, and regimental, brigade, division and corps histories. Even after 70 years, many private and public collections of manuscripts still remain unpublished, though as time goes on more and more of this material finds its way into print. Depositories such as the Library of Congress and



the Confederate Museum at Richmond contain much valuable material of this sort.

It is the policy of the National Park Service to overlook no source of information, but experience has proved that the most reliable testimony as to what took place on the battlefields of the Civil War is perhaps to be found in the volumes of the War of the Rebellion Records. Possibly the fact that reports of organization commanders were written shortly after the events they described, and were submitted to military superiors for checking and verification, accounts for the comparatively small amount of error they contain. In addition, the dispatches sent during the course of battles frequently describe troop positions at a particular hour; copies of these dispatches are included in the official reports. Thus the time when certain organizations became engaged or were repulsed, and a variety of other information are disclosed; this is all the more valuable because the report was made at the scene of action, when the fate of the battle was at stake, and there was little if any motive or opportunity to mislead. These dispatches constitute a valuable check on the official reports made after the action as well as more personal accounts, and are important in interpreting and supplementing them.

While there is much that is of value in the mass of papers written by participants after the war, the fact cannot be overlooked that these papers were not subject to an official review by military superiors who were in a position to evaluate them. Admitting that in some cases official reports have been written to hide the facts rather than to set them forth clearly, nevertheless they generally have a greater value than other types of war papers which too often are written consciously in an attempt to justify certain activities of the participant, who frequently shows a tendency to emphasize the part played by himself or by the organization with which he served. When Gen. Robert E. Lee was contemplating writing a history of the campaigns in Virginia, he wrote to his kinsman, Cassius F. Lee, Jr., who had offered him some collected material relating to the war: "I am very much obliged to you for the offer of the materials which you have collected. I think it probable that I have all the official reports, and I would not like to resort to any other source for a statement of facts." (A. L. Long's "Memoirs of Robert E. Lee," p. 4).

The National Park Service in its battle studies is inclined to put the same emphasis on official records as General Lee, though perhaps not going to such extremes.

In studying a campaign, it is our policy to make a most careful study of the official records relating to it, to determine the plans of the opposing commanders, and the movements and positions of the troops. Where there is a conflict of testimony, an effort is made to determine the true situation by a comparison of the reports of the several commanders within the same organization as well as of the reports of their adversaries. The dispatches are also studied, and resort is had to the secondary sources, especially when the official reports are incomplete. When the study has been completed, a narrative of the battle is written, fully documented. The authority for each statement of fact in the narrative is given.

Thereafter any number of uses can be made of this material. It can be used in its technical form by the student of military history. Also it can be, and is frequently readapted into more simple form for the general public, millions of whom are now visiting our park areas each year.

Accompanying each battle study prepared by the Research Division of the Branch of Historic Sites and Buildings of the National Park Service is a series of strategical and combat maps. The strategical maps show the plans of the army commanders by indicating the movements of the respective armies to the scene of action. On the strategical maps each unit shown is designated by a small square. Three XXX's denote an army corps; two XX's a division, and a single X, a brigade. The combat maps show the positions of the opposing forces at critical hours and should by themselves tell in a graphic way the story of the battle.

The base maps for these operations should represent the terrain as it was at the time of the battle. The lines of battle, including the artillery positions were, generally speaking, determined by the topography of the country. The topographical maps of the war period were military maps made shortly before the campaign, during its operations, or, as in the case of the Michler maps, about two years following the war. The maps actually used during many of the campaigns were often unreliable as to distances, roads, streams and other features. The maps made following the war are valuable in showing the culture of the period, but none of these show contour lines.

For the base map, therefore, a U. S. Geological Survey

map is used. Since these maps were not prepared on a scale sufficiently large to permit showing such details as the location of troop units, a pantographic enlargement is made of the area over which the armies operated. Modern roads and other features which did not exist at the time of the battle are omitted and such Civil War culture as roads, railroads, houses, churches, bridges and the like which were then in existence, but which are not shown on topographical maps of today are inserted. The enlarged map is made on a scale sufficiently large to permit a clear marking of the troop positions. This is usually ten and one-half inches to a mile. A pantograph, as you know, is an instrument in the form of a parallelogram for enlarging maps, plans, etc. on desired scale. If such an instrument is not available, photographic enlargements may be made.

We have here a series of strategical* and combat maps of the Second Battle of Fredericksburg, April 29 to May 3, 1863. Maj. Gen. Joseph Hooker commanded the Federal forces and Gen. Robert E. Lee, the Confederate army. For the combat maps, the U. S. Geological Survey Map, based on a survey made in 1931-1934, was used. A pantographic tracing of this portion of it, marked with blue lines, was made, and on this tracing the Civil War culture was inserted. Some of these cultural features are the Lacy House, the Marye House, Washington Farm, the Brick Kiln, and Military Road. The Telegraph Road shown on this map appears as the Jefferson Davis Highway on the original map. This pantographic tracing is made on tracing cloth. From it, brown-line prints are made.

The scale of the Geological Survey Map is two and five-eighths inches to the mile; that of the enlargement is ten and one-half inches to the mile. The contour lines with ten foot intervals are a light brown. Rivers are shown in light green. Federal troops are indicated by blue lines, Confederate by red. The size of the lettering used increases with the size of the organization The smallest sized lettering is used for showing the regiment; for a brigade the lettering is larger; it is still larger for a division, and largest of all for a corps. The actual front occupied by a given unit is shown according to scale where possible. When the position of the right and left flanks of an organization are stated in the reports, they are so indicated on the map. Where the position of the one or the other is not known, it is estimated on the basis of one yard per man.

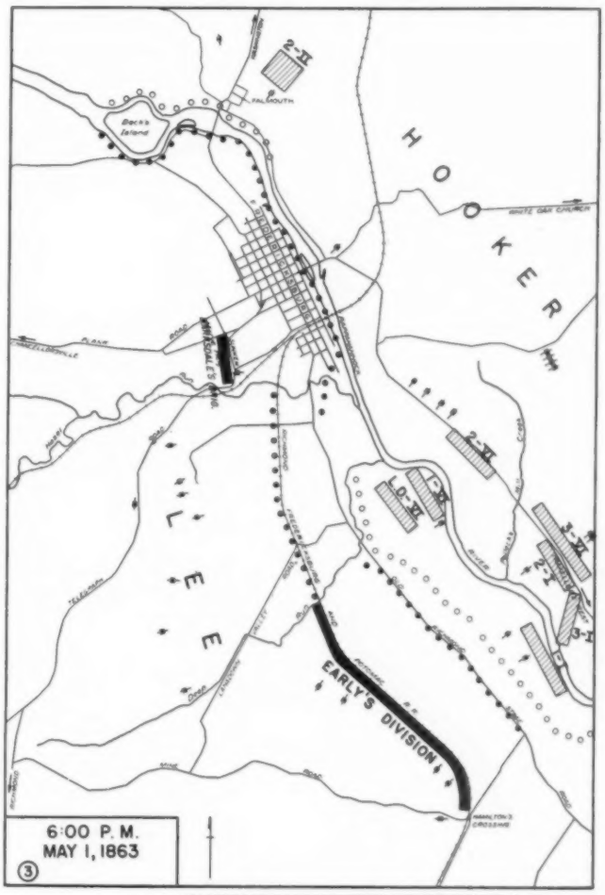
Organizations were customarily deployed in line of battle in two lines. As thus deployed, a brigade of 2000 men would occupy a front of 1000 yards. Of course there will be many instances, where an organization will occupy more, and other instances where it will occupy less, than a yard to a man. A picket line is indicated by a series of small circles. A battery is shown by a short line with a shorter parallel line on either side of it.

Three strategical maps have been made showing the movements of the opposing armies which lead to the opening of the battle on April 29, 1863. (See Strategical Map No. 1).

FOLLOWING Burnside's failure to drive Lee from his position on the south side of the Rappahannock River in the First Battle of Fredericksburg, December 11-15, 1862, the Army of the Potomac returned to the north side of the river. On January 20-24, Burnside made a none too vigorous attempt to turn Lee's left in the "Mud March" operations.

*Strategical maps are not published with this article—Editor.

The Army of the Potomac went into winter quarters in an area extending from Falmouth, opposite Fredericksburg, easterly to the Potomac River near Belle Plain and as far as Stafford Court House on the north—an area shaped like a triangle containing about sixteen square miles. Maj. Gen. Joseph Hooker, on January 26, 1863, superseded Maj. Gen.

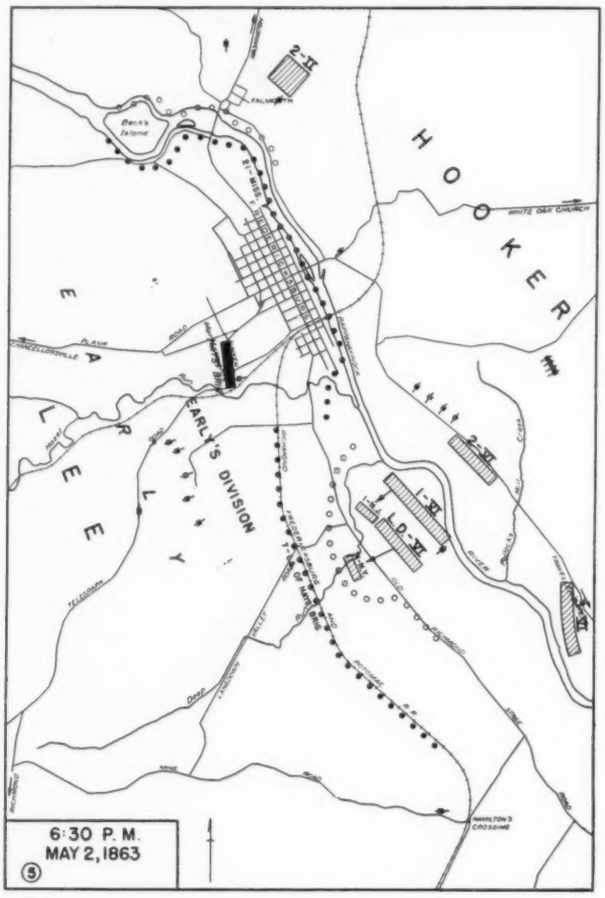


Ambrose E. Burnside as commander of the Army of the Potomac.

Gen. Robert E. Lee's Army of Northern Virginia went into winter quarters on a line extending from United States Ford on the left to Moss Neck on the right, a distance of about 30 miles.

General Hooker submitted to President Lincoln, April 11, 1863, his plan for the spring campaign. The President approved it. The Federal Cavalry was to cross the river at Rappahannock Bridge (Strategical Map No. 3), twenty-five miles northwest of Fredericksburg and moving thence by way of Culpeper and Gordonsville strike the Richmond, Fredericksburg and Potomac Railroad in the vicinity of Hanover Court House. When Lee's communications had been cut, Hooker's infantry would turn Lee's left and attack his rear. The cavalry moved on April 13, but spring rains delayed the movement and by April 26, the cavalry had not crossed the Rappahannock.

On April 26-27, Hooker issued orders for the movement of the remainder of the Army of the Potomac. The V, XI, and XII Corps were ordered to march to Kelly's Ford on the Rappahannock (Strategical Map No. 3) about 22 miles northwest of Falmouth; the II Corps, (less Gibbon's Division) was to march to the vicinity of Banks' and United



States Fords; and the I, III, and VI Corps were to put themselves in position to cross the Rappahannock south of Fredericksburg.

The Left Wing, the I, III, and VI Corps were to hold the Confederate troops in position on their front while the Right Wing, comprising the V, XI, XII and two divisions of the II Corps crossed the Rappahannock and Rapidan Rivers and swept down on Lee's rear.

About noon April 28th, the I, III, and VI Corps left their winter encampments (Strategical Map No. 1) and moved to the north bank of the Rappahannock. On the morning of the 29th (Combat Map No. 1) Brooks' 1st Division of Sedgwick's VI Corps and Wadsworth's 1st Division of Reynolds' I Corps were in position on the south side of the river as shown on the map. During the night, April 28th-29th, artillery of these three corps had been placed in position to cover the crossing of the infantry.

When Lee learned of the forward movement of the Federal Left Wing, he moved part of McLaws' Division into a previously prepared position along the heights west of Fredericksburg. Early formed on McLaws' right, with Rodes' Division on the extreme right. A. P. Hill's Division was in support behind Early. Wright's Brigade of Anderson's Division moved in support of McLaws'. Several batteries were placed in position. The Federal Right Wing had crossed the Rappahannock at Kelly's Ford and was marching to Germanna and Ely's Fords to turn Lee's left. The remainder of Anderson's Confederate Division was holding the United States and Banks' Fords.

There was no fighting on the 29th. There were no important changes in the Federal positions. More Federal batteries had been placed so as to command Sedgwick's pontoon bridges. The remainder of Jackson's Corps had arrived on the field. Wright's Brigade had rejoined Anderson. (Not shown on map). Perry's Brigade, of Anderson's Division, had taken position on the left. (Combat map, No. 2.)

Hooker's Right Wing had arrived in the vicinity of Chancellorsville. (About ten miles west of Fredericksburg). Anderson's Confederate Division (of Longstreet's Corps) was entrenching across the Orange Turnpike six miles west of Fredericksburg. (Not shown on map).

There was some artillery firing on the Federal right and Confederate left on the night of April 30th. Sickles' Federal III Corps marched from the vicinity of Fredericksburg about 2 P.M., April 30th; about 6 P.M., May 1st, it had reached Chancellorsville. (Combat Map No. 3). Newton's Division of the VI Corps moved to the left on the afternoon of May 1st, to cover Reynolds' (I Corps) pontoon bridges.

EARLY'S Division with some artillery, held the right of Lee's line. A. P. Hill's, Colston's, and Rodes' Division of Jackson's II Corps moved over from the right and joined Anderson on the Orange Turnpike, six miles west of Fredericksburg. (Not shown on map). Perry's brigade of Anderson's Division, which had held the Confederate left, and McLaws' Division, also had joined Anderson. Barksdale's Brigade of McLaws' Division, with artillery, now held the left of Lee's line in this area.

Hooker's Right Wing now formed a semicircle around Chancellorsville, covering Ely's and United States Fords (not shown on map), with Anderson's, McLaws' and three divisions of Jackson's Corps within a mile of his front. This was the position of the right of Hooker's army when Jackson made his famous flank attack on May 2nd.

About 11 A.M., May 2, 1863, Reynolds' Federal Corps was en route to join Hooker's Right Wing. There was some artillery firing early in the morning on the Confederate right.

Burnham's Light Division of Sedgwick's VI Corps had advanced about 6 P.M. up the valley of Deep Run driving the Confederate skirmishers back to the railroad. At this hour the Confederate line in front of Sedgwick consisted only of Hays' Brigade of Early's Division, one regiment of Barksdale's Brigade, and six batteries of artillery. (Combat Map No. 5). It was on the morning of this day, May 2, 1863, that Stonewall Jackson commenced his memorable flank march on Hooker's extreme right. On the night of May 1st, Lee had directed Jackson to march his Corps of about 23,000 men across the Federal front and attack the right flank of the Federal army, while McLaws' and Anderson's Divisions remained in position one mile south and east of Chancellorsville. (Not shown on map). The head of Jackson's column marched about 7 A.M. May 2nd, from a point about a mile south of Chancellorsville, and about 6 P.M. Rodes' Division hit Howard's XI Federal Corps on the flank, driving it in confusion for a distance of about two miles.

Through an error in the transmission of orders, Early left his front on the right about 2 P.M. to join the Confederate forces at Chancellorsville, leaving only Hays' Brigade and one regiment of Barksdale's Brigade to oppose Sedgwick. Early returned to his former position about 10 P.M. For about eight hours, therefore, Sedgwick's force of about 16,000 men was confronted by not more than 1200 Confederate

infantry. This then is the situation. Hooker sent the Right Wing of his army, three and a half Corps, far over to the right to turn the left of the Confederate army. Meanwhile, Lee sent Jackson to attack this same Right Wing on the flank. To accomplish this, Lee withdrew practically the whole of the Confederate force from his right, leaving little more than a skirmish line in front of Sedgwick's Corps of about 16,000 men. If Sedgwick had taken advantage of a situation which does not occur often in a military lifetime, he would have threatened Anderson's and McLaws' rear in such a manner as to have forced Lee to recall Jackson. Lee's army was divided and the parts widely separated. If Sedgwick had followed up his advantage, the 14,000 men of McLaws and Anderson would have been threatened in the rear by Sedgwick's 16,000, while about 45,000 Federal troops would have threatened their front.

AT about 10:45 A.M. May 3, 1863, Newton's, Howe's, and Burnham's Light Divisions made an attack on the Confederate sector held by Barksdale's Brigade and some artillery. All of the troops under Sedgwick's command were now south of the Rappahannock. Earlier in the morning, Gibbon's Division on the Federal right had attempted to turn the Confederate left which was then held by Barksdale's Brigade at Marye's Hill. Hays' Brigade was moved from the right of the line to meet this threat. Gibbon, however, was unable to advance because of the canal in his front. (Combat Map No. 9).

Troops from Newton's Division formed a column of attack on Commerce and Hanover Streets. Burnham's Light Division was formed in line of battle on Newton's left, extending as far as Hazel Run. Howe's Division was in three lines of battle south of Hazel Run.

Newton's and Burnham's troops took Marye's Hill. Sedgwick testified before the Congressional Committee on the Conduct of the War that he lost 1000 men in ten minutes in taking Marye's Hill. All the Confederate batteries on the Hill were captured. The retreating Confederates moved down the ravine and joined the remainder of Barksdale's Brigade on Lee's Hill and Howison's Hill on the right.

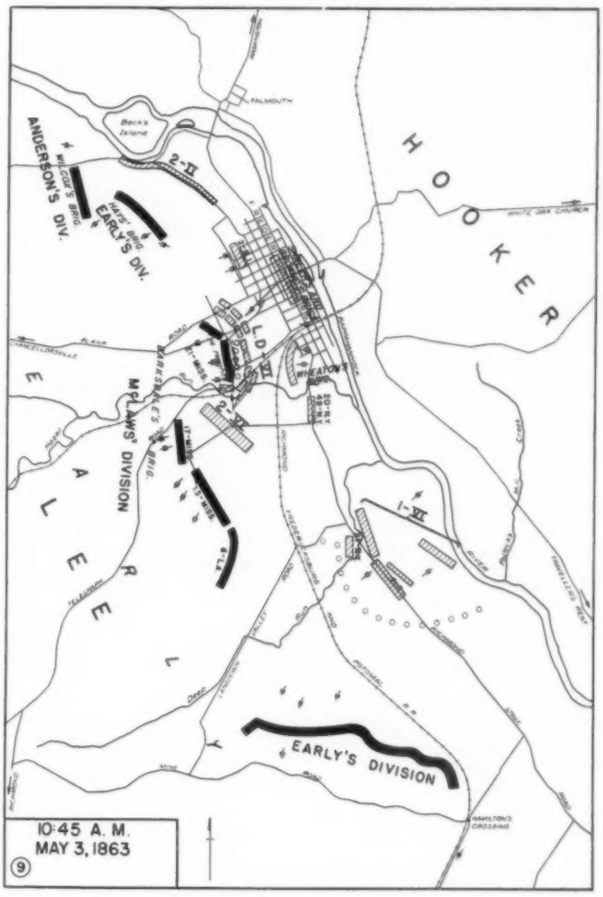
Meanwhile the artillery on Lee's and Howison's Hill delayed Howe's advance, but the Confederates were finally driven back on the Telegraph Road, losing several guns.

The batteries on the Federal left engaged those on the Confederate right during the morning, but there was no serious infantry engagement on this part of the line.

Wilcox's Brigade of Anderson's Division was brought up from Banks' Ford and placed on the left of the Confederate line to meet any threatened attack from Gibbon. Gibbon's troops suffered from an enfilade fire from Wilcox's batteries. About noon Gibbon's Division moved over to Marye's Hill. Thus ended the Second Battle of Fredericksburg.

Sedgwick's advance on the Orange Road in the afternoon was halted at Salem Church about five o'clock by Wilcox's Brigade and McLaws' Division, which had been dispatched from Chancellorsville when Lee learned that Sedgwick had broken through his line on the right.

WHEN the battle study, including the narrative and maps, is completed, markers are prepared for the field. These markers are, of course, based on the study and consist of a series of brief narratives of the battle. They are placed on the field at or near the point where the event described took



place. Almost without exception, battlefield markers are placed where they can be read from the road. The series of markers aims to give the visitor a running story of the battle. Where appropriations make it possible, trained guides are posted at contact stations near the battlefield to greet the visitor. At certain of these contact stations there is a large map of the field showing the lines of battle. The guide is qualified to relate the story of the battle, indicating the troop positions and movements on the map. If the visitor wishes, the guide will accompany him to the battlefield and take him over the ground where the fighting took place. Roads have been built through many of the battlefields making it possible to drive along the line of battle. There are also trails and foot paths by means of which the visitor may examine the old trenches and battery positions. Many of these earthworks have been restored so that in places the scene of action may be viewed as it existed at the time of the battle. The student of military history who wishes to make a detailed study of a particular battle may have access to the battle narrative and maps, thus enabling him to follow each movement of the opposing forces on the ground.

Editor's Note—Due to the unusually large size of the original strategical maps referred to by the author, it was impracticable to reproduce them herewith. The combat maps published on the preceding pages are not taken from the originals but were drawn especially for reproduction in ARMY ORDNANCE by personnel of the Historic Sites and Buildings Branch, National Park Service, Department of the Interior. They at least will show the principal military movements.

The Ballistic Equity of Duels

An Analysis of Some Nineteenth Century Dueling Pistols

By Aiken Simons and Wallace H. Coxe*

A DUEL is defined as "a combat between two persons with deadly weapons". However, it came to be more restricted in its applied meaning and referred to such a combat by prearranged terms accompanied by much ceremony and scrupulous fairness. When these were not present it was referred to as "an affray".

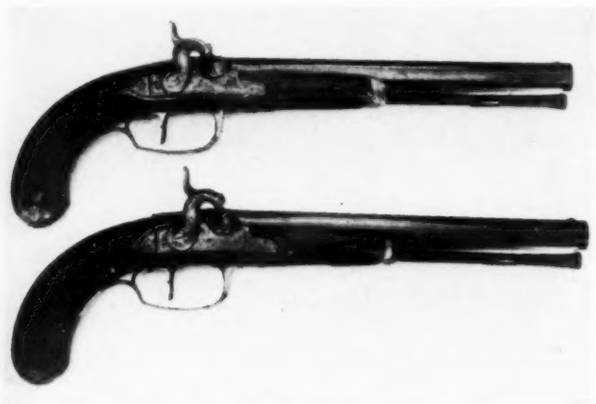


FIG. 1. MATCHED PAIR BY DURS EGG, LONDON

The custom of dueling arose from a belief in times gone by that Divine Providence would direct the outcome so that right and justice would triumph and wrong be punished. Of such a nature was the trial by combat of medieval times when the accused in a criminal case could demand that the accuser meet him in the lists and establish the truth of his assertions by force or skill. The second half of the seventeenth century through to the first half of the nineteenth century was the era in which the formal duel flourished. To render these less frequent as well as less fatal, various codes were drawn up. It would seem that most American and probably English codes were derived from the Clonmel Assizes Code drawn up when Court was in session at Clonmel, Ireland in 1777.

This code and those dependent on it called for evenly matched pistols of half-inch smooth bore with a barrel length not exceeding ten inches. Smaller pistols, rifled pistols and even shoulder weapons had been used but a barrel length of about ten inches seems to have been the normal. Custom on the Continent seems to have been less fixed and rifled pistols were not unusual. After reading the scrupulous directions in the Dueling Code written by Governor John Lyle Wilson of South Carolina in about 1825, it occurred to the writers that perhaps the precision of human action was out of all proportion to the uniformity of the firearms and the ammunition used in them. Chapter III, Section 5 of Lyle Wilson's "Code of Honour" referred to above states: "the usual distance is from ten to twenty paces, as may be agreed on, and the seconds in measuring the ground usually step three feet (tape line used)". Hence, the combat distance was from ten to twenty yards.

To determine the uniformity of a pair of dueling pistols the following were selected. All were made by excellent gunsmiths, were in first-class condition, and to all appearances or measurements each pair was an exact duplicate.

1. A pair of muzzle-loading smooth-bore percussion pistols made by Durs Egg of London, England, between 1820 and 1830. (Fig. 1). Bore diameter .497-inch; barrel length 9⅛-inch outside, 8¾-inch inside; projectile travel 8⅛-inch; total weight of each pistol 2 pounds, 1 ounce. The barrels are browned but trigger guards and fittings are bright steel handsomely engraved. They are provided with adjustable hair triggers so that the pull can be regulated to a nice uniformity. This was not done at the time of test through an oversight so that No. 1605 had a trigger pull of 8 lbs. and No. 1606 a pull of 4 lbs. Engraved on the top of the barrels are "D.C. 1605" and "D.C. 1606" respectively. Through the courtesy of the Royal Society of Antiquaries of Ireland, it was discovered that by Act of Parliament 6 & 7 Victoria C-74, Section IX, in 1843 all arms in Ireland had to be registered and marked. Each county and the cities of Dublin, Cork, Kilkenny, Limerick and Waterford had distinctive letters assigned to them and then consecutive numbers stamped as the arms were registered. In this case the D. C. refers to Dublin City.

FIG. 2. MATCHED PAIR BY T. MORTIMER, LONDON

"Ideal" round ball No. 456123 having a diameter .456-inch and weighing on an average 142.5 grains, was used with a cloth patch. Thirty-four grains of du Pont FFFg black powder were weighed out as the charge in every case. Six

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Wallace H. Coxe—Ballistic Engineer, Smokeless Powder Department, E. I. de Nemours & Company, Wilmington, Del.

shots were fired in each series, the pistols being cleaned after each shot and the velocity recorded over a range of 50 feet and shown as of 25 feet. Results were as follows:

	Pistol 1605	*Pistol 1606*
Mean velocity, feet per second	1036	958
Extreme variation, feet per second	150	57
Mean variation, feet per second	40.2	16.2

Thus pistol 1606 showed markedly lower velocity and greater uniformity.

2.—A pair of muzzle-loading smooth-bore percussion pistols (shown in Fig. 2) made by T. Mortimer, a London gunsmith, between 1825 and 1832 of the following general description: bore diameter .462-inch; barrel length outside 3-13/16-inch; inside 3-5/16-inch; projectile travel 3-13/16-inch; total weight 12-5/16 ounces. Trigger pull No. 1, 1¾ lbs; No. 2, 2 lbs. These pistols are much shorter and lighter than the Eggs and might be considered rather innocuous at twenty paces. None the less there are cases on record when such arms were used.

"Ideal" round ball No. 424101 having a diameter .424-inch, weighing 114.4 grains was used with a cloth patch and 21 grains of du Pont FFFg black powder was the charge in every case. The test conditions were the same as before and results were:

	Pistol No. 1	*Pistol No. 2*
Mean velocity, feet per second	709	686
Extreme variation, feet per second	79	100
Mean variation, feet per second	22.3	36

In this case the difference in velocity was observable but the pistol lower on the average showed the greater variation.

3.—A pair of muzzle-loading rifled percussion pistols (Fig. 3) of Belgian manufacture and proof-tested at Liége. The name of the makers is not marked on the piece. Probable date 1840-1850. The rifling consists of 48 shallow grooves having a twist of one turn in 13 inches or about one turn in 26 calibers.

Description: bore diameter .505-inch; length of barrel outside 9½-inch; inside 8-7/16-inch; total length of pistol 15½-inch; projectile travel 8 inches; total weight 2 lbs., 6 ounces. The trigger pull with No. 1 pistol is 4 lbs.; No. 2—4½ lbs.

This is distinctly a heavier and more deadly weapon than the others tested and does not comply strictly with English or American Codes but undoubtedly such were used in both countries.

"Ideal" round balls No. 456123 having a diameter of .456-inch and weighing on the average 142.5 grams were used with a patch. Powder charge 34 grams of du Pont FFFg. Under regular test conditions, the results were:

	Pistol No. 1	*Pistol No. 2*
Mean velocity, feet per second	966	908
Extreme variation, feet per second	98	63
Mean variation, feet per second	20.2	28.7

Here the higher velocity shows the greater extreme and less mean variation.

When it is considered that the bullets used in actual fighting were hand moulded, often very crudely, and were generally "out of round", that the powder was measured, and the loading was apt to be affected by the tense emotional strain of the seconds, it is safe to assume that conditions were far less favorable than in the above tests made under laboratory conditions, which none the less, show a marked dissimilarity between pistols of a pair.

They were, of course, hand made and very carefully so. They were, in fact, the finest weapons of their time, skillfully inlaid and beautifully engraved. This demonstrates that the thought of the time judged equality by the appearance of the weapons. Although the demand for equality was not satisfied either by the ballistic possibilities of the weapons or their appearance, one great factor existed that was little known at that time. This factor depends upon the complex nervous system of every human being and the great differences between individuals.

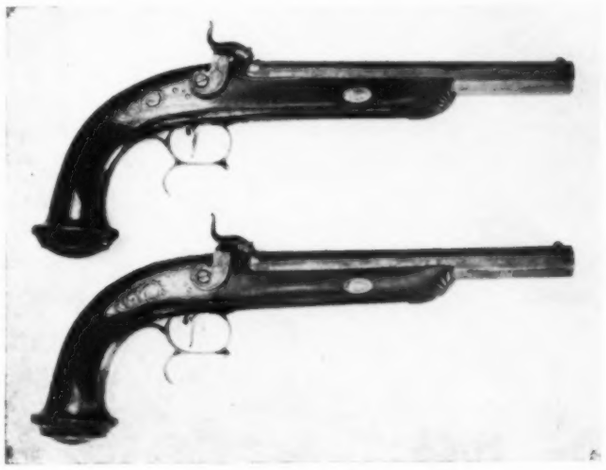


FIG. 3. MATCHED PAIR, BELGIAN MAKE

BEFORE discussing this point, however, let us consider the time factors that were involved in shooting "matched pistols". Taking the extreme difference of seventy-eight feet per second between Pistol No. 1605 and Pistol No. 1606, for example, the elapsed time for the former, or high-velocity pistol, was determined to be .0483 of a second; and for the latter, or low-velocity pistol, .0522 of a second—a difference or time lag of .0039 or roughly .004 of a second.

Now, four-thousandths of a second is too fast a time interval for the human being to appreciate or comprehend except in the abstract. As a matter of fact, an individual is unable to reduce the time reaction between the instant when he has sighted the gun and pulled the trigger to less than approximately twelve hundredths of a second. The average time is in the neighborhood of two-tenths of a second while a person with slow reaction would consume as much as three tenths of a second before his trigger finger would respond to the implicit command to fire. This difference in physical reaction can be appreciated better by observing the scores made by the best match shots as compared to the difficulty which many individuals have in merely qualifying for a place on a team. The best shots are invariably better equipped physically and nervously, and coördinate more smoothly than the poor shots.

Thus it can be seen that even if the ballistic inequalities of the dueling pistols were eliminated, it would be impossible to draw rules and customs governing their use that would put each antagonist on the same terms of equality. It will be readily admitted that practice will improve a shooter's coördination and will tend to reduce his time reactions but not to the degree of equality which can be obtained by mechanical perfection.

Another Dardanelles "If"

Would Air and Chemical Arms Have Changed Nelson's Dictum?

By George J. B. Fisher*

MUCH has been written of the Dardanelles Expedition—volumes of indictments, apologies, explanations. Yet these tides of words have ebbed and flowed without effacing the stark structure of a supreme historic tragedy; its rugged outlines will always remain, unaffected by the spray of meager pens, a glorious testimony to heroic striving. Amongst these post-mortems which the failure of the operation amply evoked, is that of the redoubtable Lord Fisher. He wrote: "I was absolutely unable to give the Dardanelles proposal any welcome, for there was the Nelsonic dictum that 'any sailor who attacked a fort was a fool' ".

Yet a century or so before, another British admiral had defied these same forts—passed them on the way in to the Sea of Marmara and ten days later, passed them again on the way out, with only inconsequential losses. Why was it that Duckworth, with wood and sail, was able to succeed where Carden and de Robeck, with iron and steam, so decisively failed? Assuming equal valor on all sides, the answer must be found not in personnel but in matériel.

In the particular era of the World War (which we can now observe with some degree of historical perspective) the evolution of mechanical science had tipped the scales to favor land force and thus *for the moment* confirmed the "Nelsonic dictum", whereas in the earlier day its weight tended less strongly against naval force. So there appear to be grounds for qualifying the Nelsonic observation to the extent that a sailor is a fool to fight a fort *when the weight of defensive weapons is against him.* Yet this weight is not always against him! When it happens to be with the sailor, when the sun of science shines behind him instead of into his eyes, then it would be folly *not* to attack a fort if the prize be as alluring as was that which dangled before the British Admiralty in 1915. The time has now come to inquire whether, in the eternal balance between offensive and defensive, science has not perfected weapons which again justify the fighting of land forts from the sea.

Two outstanding innovations of the World War, since perfected in considerable degree, are the air and chemical arms. At the Dardanelles the British had a few fledgling planes, while the Turks, just before the evacuation of the Gallipoli Peninsula, brought forward some rudimentary gas installations. But in their modern development, neither of these weapons was available to the forces engaged at the Dardanelles in 1915. Had both been at hand, could the outcome of the operation have been different? Could Carden, as did Duckworth, have entered the Sea of Marmara, there to destroy the Goeben and Breslau and then shell Constantinople? The political aspects of this speculation are fascinating; but a more useful purpose will be served in prodding these dead ashes if out of past possibilities we can conjure future probabilities in the field of naval action.

On January 11, 1915, Vice-Admiral Carden dispatched from the Mediterranean the detailed plan of his proposed operation against the Dardanelles. This was in reply to an inquiry from the British Admiralty how, according to his previous report, the Dardanelles "might be forced by extended operations with large number of ships." The plan of Admiral Carden was laid before the British War Council on January 13. The official record of its consideration states:

> "The sense of Admiral Carden's reply was that it was impossible to rush the Dardanelles, but that, in his opinion, it might be possible to reduce the forts one by one. To this end Admiral Carden had submitted a plan. His proposal was first to concentrate his fire on the entrance forts. When they were demolished he would proceed to deal with the inner forts, attacking them from the Straits and from the seaward side of the Gallipoli Peninsula. . . . Three modern ships, carrying the heaviest guns, would be required for reducing some of the more modern works, and about twelve old battleships would deal with the remainder. . . . Once the forts were reduced the mine-fields would be cleared, and the Fleet would proceed up to Constantinople and destroy the Goeben."

Let us note here that the view of the naval commander in the Mediterranean did not originally comprehend a joint military and naval operation. In London the Admiralty's technical advisers thought otherwise; they inclined from the start toward strong land force to secure the Gallipoli Peninsula. But Carden said, in effect: An ordinary naval diversion won't work—but give me the ships and enough time and I will work out a large scale naval diversion that will fill the bill . . . . This was the view that the First Lord of the Admiralty eagerly seized upon and sold to the British Government.

NOW I propose to explore the proposition whether, given modern air and chemical weapons, this naval operation, then designated as the "Pola" plan, could have succeeded.

In such a speculation numerous assumptions must of course be granted. Unquestionably it is to be conceded that the physical conformation of the Straits is such that, adequately defended, they should be able indefinitely to defy naval attack. Yet the fact remains that they were not defended with the fullest adequacy early in 1915, else their assault could not under any circumstances have been condoned. Whence arose the *opportunity,* which certainly in some measure presented itself in the opening days of the operation. The question then is whether, had the British Navy included amongst its resources, *when Carden's plan was formulated,* these developments of post-War science, could naval force have prevailed against the specific opposition it encountered? This inquiry, if it is to shed any light upon future warfare, must impartially bestow these benefits alike upon defender and attacker.

Air force would have enhanced the capabilities of the defense, just as it could have profited the British fleet. But

*Major, Chemical Warfare Service, U. S. Army.

it is a peculiarity of chemicals that they constitute a decidedly lesser threat against a fleet than they do when directed against seacoast fortifications; this is so primarily because the fleet embodies movement and the sea surface defies contamination, whereas the fixed fort presents a ready target for both cloud and persistent gases.

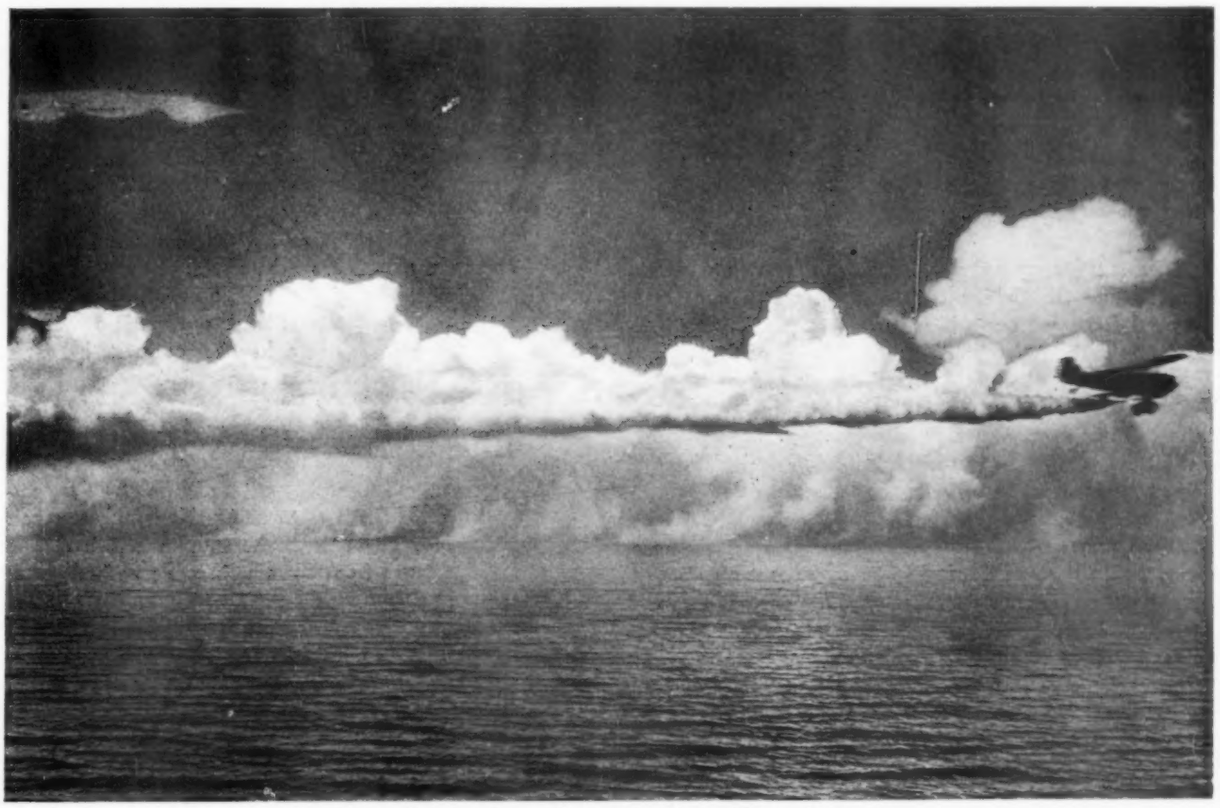
The detailed Carden plan for the reduction of the Dardanelles defenses, as transmitted from Malta on January 11, 1915, is presented by Churchill in "The World Crisis", Vol. II. This plan is here repeated verbatim, except for certain italicized additions, inserted to suggest how today the same operation might be approached.

"Reference to Naval Intelligence Department report No. 838, Turkey Coast Defence 1908. Possibility of operations: (a) total reduction of defences at the entrance; (b) clear defences inside of Straits up to and including Kephez Point Battery No. 8; (c) reduction of defences at the Narrows, Chanak; (d) clear passage through minefield, advancing through Narrows, reducing forts above Narrows, and final advance to Marmara. Term defences includes permanent, semipermanent, and field works, also guns or howitzers whose positions are not yet known.

"Whilst (a) and (b) are being carried out a battleship force would be employed in demonstration and bombardment of Bulair lines and coast and reduction of battery near Gaba Tepe. *Neutralize Bulair road from air with persistent chemicals; also E-W roads serving garrisons on west side of Peninsula and elsewhere as needed.* Force required, 12 battleships, of which 4 fitted with mine-bumpers. *Two airplane carriers.* Three battle-cruisers—2 should be available on entering Marmara—3 light cruisers, 1 flotilla leader, 16 destroyers (*4 fitted for dispersing gas clouds*) 1 depot repairing ship, 6 submarines, 4 seaplanes, *2 squadrons, R.N.A.S. (supplied with chemical tanks)*, and 12 mine-sweepers, including perhaps 4 fleet sweepers, 1 hospital ship, 6 colliers at Tenedos Island, 2 supply and ammunition ships. The above force allows for casualties.

"Details of action: frequent reconnaissance by seaplanes indispensable, *especially to definitely locate mine fields by aerial photography.* (a) Indirect bombardment of forts, *using HE, HE-CN and persistent gas,* reduction completed by direct bombardment at decisive range, *closing of ranges to be covered by destroyers laying irritant gas clouds, anchorages within range of shore guns to be blanketed where necessary with smoke pots;* torpedo tubes at the entrance and guns commanding minefield destroyed; minefield cleared. (b) Battleships, preceded by mine-sweepers, enter Straits, working way up until position reached from which battery No. 8 can be silenced. *Action to be screened by smoke from seaplanes, destroyers and smoke pots where necessary.* (c) Severe bombardment of forts by battle-cruisers from Gaba Tepe spotted from *seaplanes or* battleships; reduction completed by direct fire at decisive range. (d) Battleships, preceded by sweepers, making way up toward Narrows. Forts 22, 23, 24 first bombarded from Gaba Tepe, spotting for 22 by seaplanes, then direct fire. *Chemical bombs to be released against forts where necessary to facilitate reduction.* Sweep minefields in Narrows, *under cover of smoke screens,* the forts at Nagara reduced by direct fire, battle force proceeds to Marmara preceded by mine-sweepers.

"Expenditure on ammunition for (c) would be large, but if supplies sufficient, result should be successful. Difficulty



PLANE LAYING SMOKE SCREEN TO COVER NAVAL ACTION

as to (b) greatly increased if Goeben assisting defence from Nagara. It would, unless submarine attacks successful, necessitate employment of battle-cruisers from Gaba Tepe or direct.

"Time required for operations depends greatly on morale of enemy under bombardment *which should be definitely lowered by extensive use of irritant and persistent gases;* garrison largely stiffened by the Germans; also on weather conditions. Gales now frequent, *but prevailing winds from south-west considered favorable to gas features of plan.* Might do it all in a month about . . . ."

Now, having committed Vice-Admiral Carden to certain complicated supplements to his well-prepared plan—in which this capable commander would probably have concurred had he shared our present knowledge—it is proper to examine in some detail how they *might* have contributed to a different outcome.

THE first superimposed task is the neutralization of certain roads feeding the Gallipoli Peninsula; surely a novel task for naval force, yet one which is here unquestionably indicated. As a matter of fact, the possibilities of *interdiction* were immediately recognized by both the British and the Turks, yet the means then at hand were inadequate to decisive results. The overland movement of guns, ammunition, and all the paraphernalia which was being pushed forward during the early months of 1915 to strengthen the Dardanelles defenses, was exceedingly difficult. Every additional handicap that could have been imposed upon such movements would have netted decisive advantages to the British. The Peninsula proper was supplied from a railhead at Ozun Keupri, a hundred miles away. The Turks having virtually no motor transportation, bullock and buffalo had to be depended upon for movement over the single dirt road winding southwest to Bulair. Here the road formed a bottleneck, presenting a natural and ideal target for neutralization with mustard type chemicals.

On the Asiatic side of the Straits, the country being more open, no such glittering opportunity was offered, although any blockage of the road skirting the shore from Kephez south past Battery No. 8 would have interfered with the supply of all the Asiatic installations south of the Narrows. The strategic neutralization of important roads with mustard would have forced the Turks to depend almost entirely on water transport for advancing supplies; which, because of the minefields below Chanak, was by no means easy. This neutralization by mustard could have been undertaken on occasion by gunfire, although its accomplishment by plane would have been more satisfactory and more economical.

Let us next consider the operation (a), inquiring how chemicals could have aided the ships in overcoming the entrance forts. The opening action was conducted by ships standing outside the range or bearing of the guns of the outer forts. The purpose of this initial bombardment was to so paralyze the fire-control arrangements of the forts that their action would be ineffective when the ships moved within medium and finally close ranges to execute the decisive phase of their reduction.

Fire for destruction from the outer ranges was impracticable. An occasional shell might hit a gun; and when it did, might damage it. But this was no more in the order of probability than was the direct hitting of a gun on shipboard. The ship fired at the *fort* as the fort fired at the *ship*. If either happened to hit the other's guns, well and good—but the fort picked up a naval target hoping to sink the ship, while the ship took under fire not a point target within the fort, but an area target including the fort, hoping that its bombardment would put the whole fort out of action. If it succeeded in sufficiently neutralizing the fort, then the ship could move in to closer range and fire directly at the fort's guns, or at least advance the neutralization sufficiently so that demolition parties could be landed and complete the work of destroying the guns.

This fire of neutralization comprised two elements: effect on matériel and effect on personnel. One type of projectile served for both types of effect. The explosive shell could be expected to shatter masonry, disrupt communication and observation facilities, possibly explode ammunition dumps, even render weapons themselves unserviceable. Its effect on personnel, while immediate, was not so conclusive.

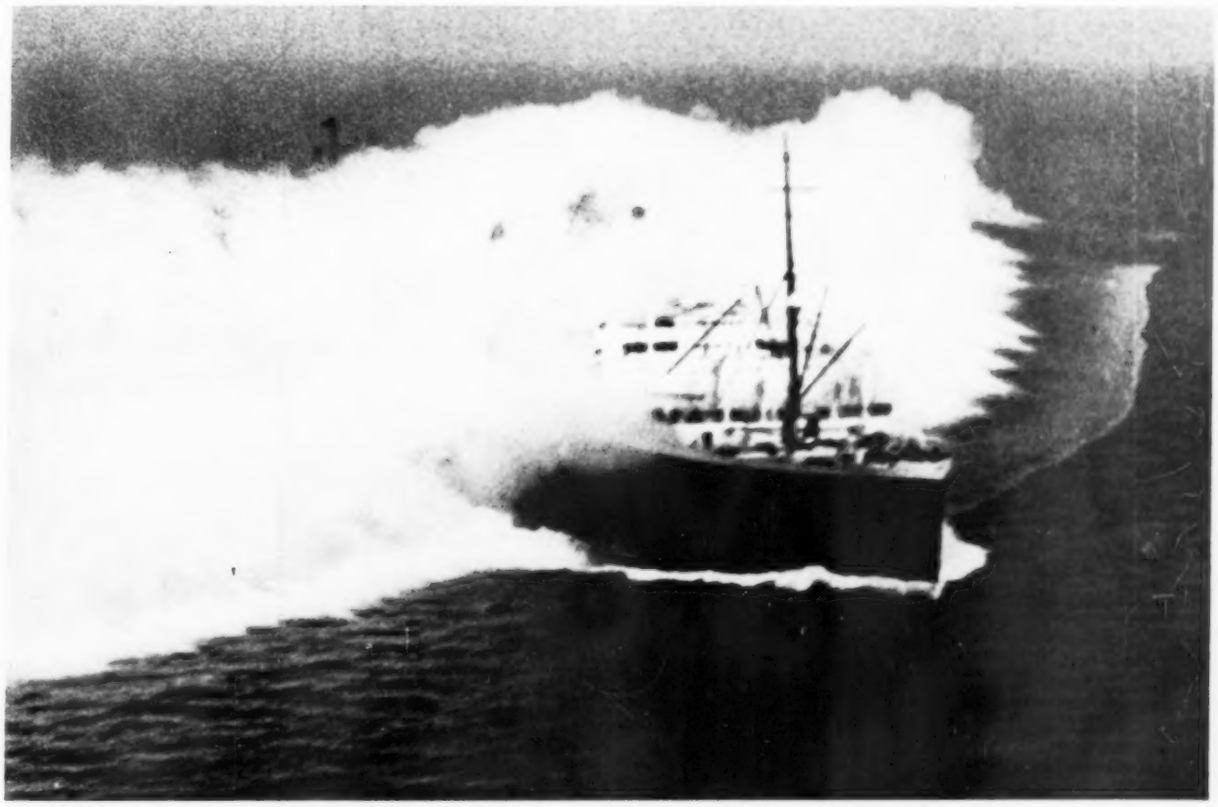
Once the range had been found, the opening of fire for effect would force men to cease the service of their guns and seek shelter. Yet the effect of the high explosive shell is instantaneous; a few seconds after its detonation is completed the shell is transformed into a handful of inert, harmless fragments. Likewise, once the bombardment ceases, gun crews emerge from their shelters, repair what damage they can, and may soon again have their batteries in working order. Thus, while the effect of high explosive shell on matériel is great, the transitory nature of its effect on personnel often results in gun crews being able largely to repair the destruction of matériel in the interim which elapses while the ships move from their long range anchorages to take up closer positions for the second phase of their action.

The effect of the chemical shell is entirely against personnel; its value against matériel is negligible, since it does not burst with any great force. But again, that effect is continuing and cumulative; it is greatest after the bombardment ceases, when men commence to return to their batteries. The chemical agent serves to keep personnel under a degree of continuous bombardment while the battleship diminishes its fire and closes on the fort.

THE two types of chemical agent suitable for naval shell are quite different in action. Mustard gas is a casualty agent. Men may sustain serious lung injuries by breathing its slowly generated vapor. Respirators will protect their lungs but can offer no protection against the vesicant effect of this vapor upon their bodies. And direct contact with the liquid, scattered about from the ruptured mustard shells, results in contamination which, unless immediately cleansed, will produce painful burns. The only way that men may safely approach works which have been shelled with mustard is under the protection of specially devised clothing which is practicable (and usually available) only for small groups of specially trained degassing squads.

Tear gas, unlike mustard, causes no casualties. The intense irritation of the eyes, which every one in the vicinity of a ruptured tear gas shell suffers, is quickly relieved by quitting the area and seeking fresh, uncontaminated breezes. Or one may, with a respirator, remain indefinitely in the tear-gassed area. But one or the other he must do—he must get out or he must mask. And if he masks, then his efficiency as a gunner is materially impaired; the operations of observing, plotting, commanding, loading and firing are all stepped down to the tempo of "slow motion".

To tear gas can be imparted a degree of persistency, but of considerable less duration than that of mustard. The latter agent, scattered over masonry, may persist for months as a dangerous hazard to personnel. The tear agent dissipates much more quickly, yet its effect continues in appreciable degree for a matter of hours. A particular advantage of the eye-irritant chemical agent, however, is found in the fact that such small quantities are needed, in comparison to mustard, to produce its particular effect. Broadly speaking, one shell freighted with tear gas will serve where ten mustard-filled shells must needs be fired. Each type performs a distinct task, yet tear gas accomplishes its limited mission very cheaply.



SCREENING EFFECT OF SMOKE IN CONCEALING A LARGE STEAMSHIP

It is possible to add effective proportions of tear gas (CN or chloracetophenone) to the normal filling of high explosive shell without seriously impairing explosive effect, at least when directed against shore facilities. But such projectiles are probably of secondary value when the release of irritant-gas clouds from destroyers running to the windward of forts is practicable.

Such clouds are capable of traveling considerable distances across water. And the component chemical constituent of the cloud does not suffer dilution; it is dispersed in such manner as to be capable of moving for miles before finally settling out. This insidious agent carries no scent and frequently gives no visual warning of its presence. None but the most perfect of masks will protect against it, while a few breaths unconsciously inhaled are sufficient to induce nausea and severe physical debility extending over a period of hours.

Here in fact is a practicable (if less dreadful) realization of one of Lord Fisher's dreams which he vividly describes as: "A miasma like the invisible, scentless, poisonous—*deadly* poisonous—gas with which my dear friend Brock, of imperishable memory and Victoria Cross bravery, wickedly massacred at Zeebrugge, was going (in unison with a plan I had) to polish off not alone every human soul in Heligoland and its surrounding fleet sheltered under its guns from the Grand Fleet, but every rabbit." If irritant gas could not have accomplished all of this at the Dardanelles, it at least, in conjunction with mustard, could have made the defenders very miserable.

THE first shot against the Dardanelles forts was fired by H.M.S. CORNWALLIS at 9:51 A.M. February 19th. From then on the action proceeded, with what appears to be considerable deliberateness: first, to bombard from anchored out-of-range positions; second, to fire under way from within the water areas covered by the shore batteries. These two phases were completed in about five hours. The silence of Kum Kale and Sedd el Bahr and their supporting forts then hopefully inspired Admiral Carden to signal "Cease fire and examine forts." But as the ships closed to execute this order they were greeted by hot fire from both Helles and Orkanie, the two supporting forts. This introduced a complication which finally compelled the action to be broken off before the reduction of the outer forts could be completed, because the British, with their ships silhouetted by the setting sun, did not feel justified in risking a loss at this stage of the operation.

This action is significantly summed up by Corbett: Naval Operations, Vol. II: "On the whole the first day's experience

was promising for the success of the enterprise. It seemed clear that an hour's more good light would have entirely finished the entrance forts, yet in one important particular the results were disappointing. Eventual success depended mainly on the superiority of the fleet in long-range armament, and the unexpected activity of Forts Helles and Orkanie at the close of the day had shown, in the Admiral's opinion, that the effect of long-range bombardment on modern earthworks was slight. They appeared to have been hit by a number of well-placed 12-inch common shell, but when the critical moment came all the heavy guns which these forts contained were in action."

In other words, explosive shell are no more effective against well designed forts than they are against trenches. The use of another weapon is therefore not only desirable, it is requisite. Land warfare's solution of this problem—chemicals—must be seen to have an application also in this particular field of naval warfare.

When finally the four forts guarding the outer portals of the Straits had been disposed of, the British naval commander encountered stubborn and indeed insurmountable resistance from the intermediate defenses. Although the speed and armor of the British battle cruisers would probably have enabled at least two of them to run by the guns of these intermediate defenses, these vessels would have been helpless before the fire of the much heavier and permanently emplaced guns of the inner defenses. The silencing of the guns of the inner defenses was therefore a vital feature of the entire naval operation.

The eleven strings of mines which eventually were stretched between Chanak Kale and Eren Keui became, in the opinion of von Sanders, the really indispensable elements of the Dardanelles defenses. They had to be swept before battleships could navigate the Narrows, even before the fleet could approach closely enough to attack the 14-inch rifles near Chanak Kale. Once swept, however, the channel became clear, for the Turks could replace no mines.

THE task of clearing the mine fields was undertaken with all the reckless bravery that characterized this whole hapless operation. The British properly elected to sweep the fields at night. The trawlers available for this purpose were underpowered for the fast currents of the Straits, yet they probably could have succeeded in clearing a path for the fleet except for the fire of the light guns of the mine defense area. This fire, aided by searchlight beams which made perfect targets of the slowly moving trawlers, was so disastrous that after repeated attempts the admiral finally was obliged to conclude that the defenses were too well organized to permit of successful night sweeping. Here in fact was wrecked the whole naval operation. In the final analysis it is an open question whether the attack of the Straits failed because of the lowly 3-inch field guns or because of the searchlights that enabled them to fire so effectively.

The Turks had only eight searchlights, half on the Gallipoli and half on the Asiatic coast. Four were mobile; four were stationary lights. It does not appear that the fire of the destroyers that escorted the trawlers was able at any time to extinguish them. On one occasion the cruiser AMETHYST desperately offered herself as a target to draw fire from an escorted minesweeper, thereby sustaining sixty casualties. But such gallantry was no solution to the problem of the searchlights which night after night promptly silhouetted the trawlers as soon as they approached the mine fields.

However, modern smoke matériel does provide a solution. Today it is easily possible for fast destroyers to run by mine defense weapons and to drop off smoke pots which, floating on the water, quickly set up a suitable obscuring screen. Such devices continue to emit smoke for considerable periods. They may be renewed as the situation demands, so that such operations as mine sweeping can be positively and adequately concealed from the shore at insignificant expense of either time or effort. Not only would smoke pots have been invaluable to the British in their minesweeping operations at the Dardanelles; they might also have been effectively used to conceal heavily weaponed ships entering the intermediate defense area to bombard the fortifications of the inner defenses.

IT was the fire of concealed mortars and howitzers that deterred the anchoring of British battleships within the Straits, thus preventing accurate fire against such forts as Hamidieh I and Chemenlik. These weapons were nearly useless against moving targets, yet they were deadly against anchored ships. Few of them were ever accurately located; moreover their mobility insured them large freedom from successful naval attack. But a screen of smoke maintained between mortars and battleships would have been one certain means of counteracting them.

Given some measure of air force, the Turks would then undoubtedly have undertaken aërial instead of terrestrial spotting for their high-angle firing. Modern smoke tactics would in this event indicate blanketing instead of screening the anchored ships, thus affording complete concealment. This in turn prevents direct firing of the ships' guns but does not in the least interfere with the receiving from aërial observers of radio reports of salvo impacts—data which were probably the best that could have been had.

Smoke tactics are certain to influence strongly future naval action. The fact that they did not do so at the Dardanelles is nothing more than an indication that the proper materials were not then available. Today planes, destroyers, and floating pots or mines, all contribute to measures of concealment. Tomorrow may witness naval battles conducted from aloft, battles in which a stage setting of protective curtains will be carefully prearranged. The future in fact promises much of technical advantage, but this alone does not afford assurance that we may be more victorious than those leaders of another day who, with lesser weapons, so bravely set about their indicated tasks.

Two Modern Combat Vehicles

Unusual Features of New Armored Car and Tank

By Robert J. Icks*

TWO newly designed combat vehicles recently have been developed in England, by the firm of Straussler Mechanization, Limited, of London. This firm was organized during the early part of 1934 around a nucleus of a great deal of practical experience in the field of military mechanization. Included in the board of directors are such names as Maj. Gen. S. C. Peck, formerly Director General of Mechanization at the British War Office; Mr. T. O. M. Sopwith, the noted airplane manufacturer, and others. The Technical Director is Mr. Nicholas Straussler, who is well known as a designer of armored vehicles and auxiliary equipment, and formerly affiliated with Vickers Armstrongs. With such an imposing group of technical minds there is small wonder at the quality of the first of the designs produced by this firm.

The first armored vehicle built by Straussler Mechanization Ltd. was Armored Car I, an experimental forerunner of the car now in production, Armored Car II. This armored car was developed with military requirements in mind and is not built around a commercial chassis but is a special military design.

STRAUSSLER ARMORED CAR II, SHOWING ARTICULATED AXLE
The duplex underslung springs make a stable gun platform.

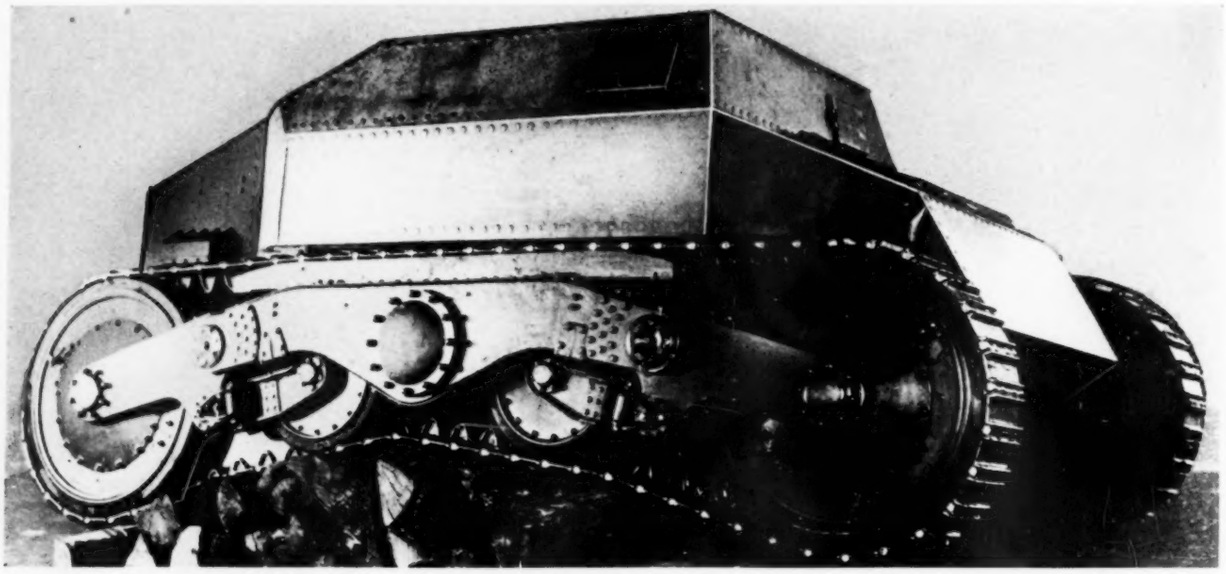
Armored Car II is short and wide with a hull specially designed to give a maximum of space and of protection with a minimum of weight. It consists of four 6-mm. rolled plates united by welding and riveting. The unique shape of the forward part gives a great deal of protection for armor of this thickness. Cross-country mobility and ease in crossing obstacles are enhanced by the fact that the hull projects only slightly beyond the tires front and rear. In addition, the hull contains a double flooring beneath which is placed auxiliary equipment and the fuel tanks, so that the entire hull can be lifted off as a unit by unfastening the staybolts. There is in the fighting compartment sufficient space for the crew of five men and their equipment. The driver sits at the very front of the vehicle so that dead space is at a minimum. Auxiliary controls are arranged at the rear of the car for driving backward. The 4-cylinder 100-h.p. combined air- and water-cooled engine is located at the rear of the vehicle. A turbine type radiator cools effectively in either forward or backward travel. The engine compartment is separated from the fighting compartment by a bulkhead. Very satisfactory ventilation is obtained by drawing out the air from the fighting compartment by means of an exhaustor turbine. The turret has 360° traverse and mounts either one or two machine guns.

THE hull is mounted on the frame which is sprung to the axles by means of duplex transverse springs. Articulation of the front axle is so complete that one wheel actually can be raised some 2 feet 6 inches without the other wheel leaving the ground or losing traction, while the hull remains practically horizontal. The duplex underslung springs prevent disablement of the vehicle even should spring breakage occur. The independent wheel springing gives a high degree of comfort in driving even over rough ground and naturally makes for an exceptionally stable gun platform.

Ground clearance is high for a vehicle of this type, 1 foot 9 inches under the hull and 1 foot 2 inches under the axles, and there are no projections of any kind beneath the car. Steering is easy at all speeds through independent worm and gear for each wheel. Maneuverability is very good, the car having a turning circle of 30 feet. Balloon tires of 225x1000-mm. size are used, enabling the car to negotiate soft, sandy or muddy ground. Drive is to all four wheels.

The maximum forward speed is 60 miles per hour and the maximum backward speed is 50 miles per hour. For good going at the higher speeds the front-wheel drive and the rear-wheel steering may be disengaged by means of a simple lever which action permits the car to operate more economically. Normally the car has a gasoline consumption of 10 miles per gallon and a radius of operation of 400 miles. The latter can be increased to 800 miles with larger gasoline tanks. Hydraulic four-wheel brakes with vacuum booster are used and there is also a hand transmission brake. The general specifications are: 12 feet length; 7 feet 3 inches width; 5 feet 10 inches tread; 9 feet 10 inches wheelbase; weight 4 tons loaded; two 6-speed transmissions. A later model, Armored Car III now is being produced. It is identical with the former except that the horsepower is 120.

*Coauthor (with Rarey and Jones) "The Fighting Tanks"; (with Hacker, Merker and Zezschwitz) *"Taschenbuch der Tanks"*. Captain, Infantry (Tanks) Reserve, U. S. Army.



The Unique Track Assembly of This Tank Permits Great Degree of Shock Absorption

VERY recently, Straussler Mechanization, Ltd., has produced a light tank having an entirely new principle of suspension. The hull of this tank is conventional, being somewhat similar to that on the light tanks now in use in the British Army. The vehicle is not yet armed since a turret has not been fitted to it, and it is still in the experimental stage. However, its most interesting feature is its suspension which is unique in many respects and quite suitable for a light tank. The principal feature of this suspension is that each track assembly is attached as a unit at one point at the center of the vehicle, one assembly on each side. Each separate assembly consists of two large outside wheels, both of which are rubber-tired sprockets positively driven, and two smaller inside wheels or track rollers, which are idlers. One large drive sprocket and one small track roller form a bogie. These bogies are hinged to the front and rear of a central swinging beam, the center of which forms the above mentioned single attachment to the hull. In operation, this central beam can swing on its pivot and, in addition, the bogies can swing independently at the end of the beam in an articulated manner.

The only springs are between the arms carrying the large and small bogie wheels at either end of the swinging beam. The beam is connected at its end to the corresponding beam on the other side of the tank by means of a cross-articulating system of bell crank levers and rods in tension which stabilizes the front and rear of the tank, preventing it from pitching. Any clockwise movement of one beam imparts an equal but counterclockwise movement in the corresponding beam on the other side of the vehicle through this cross-articulating gear. The entire track assembly unit is rigid and all movements can only take place in the plane of the track assembly which moves in a vertical plane parallel to the longitudinal axis of the vehicle. Extremely large movements are obtained without taking into account the flexibility of the springs. The limit of movement of the outer drive sprockets is approximately 2 feet 6 inches. The fulcrum centers are so arranged that the larger wheels are on longer arms than the track rollers. Consequently, only about 40 per cent of the vehicle weight is on the sprockets and 60 per cent on the track rollers, making possible very easy steering due to the heavier loading of the tracks toward the center.

Excellent results have been obtained with this suspension and very broken ground can be traversed with practically no movement of the hull, thus providing the stable gun platform so desirable and so difficult to obtain in a small tank.

Several years ago rumors were heard of a device for making light tanks amphibious. This was a Straussler development and consists of two boat-like pontoons which can be fastened to the sides of a light tank, literally ferrying it through the water. Forward motion in the water depends upon the motion of the tracks although a modification permits the attachment of a propeller through a power takeoff. This device also has been used in testing the light tank.

Light Tank Made Amphibious by the Addition of Pontoons to Sides

ARMY ORDNANCE

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Month by Month

IN conformity with its custom of many years ARMY ORDNANCE dedicates the frontispiece of this issue to him whose likeness it is—Maj. Gen. Frank R. McCoy, newly appointed commanding general of the Second Corps Area, with headquarters at Governors Island, N. Y. His service to country and to humanity has justly earned for him the title of soldier and statesman—a combination of qualities somewhat rare in the affairs of men.

MAJ. GEN. FRANK R. McCOY

General McCoy, a native son of Lewiston, Pa., was graduated from the United States Military Academy in 1897 and from the Army War College in 1908. Advancing through grades he has served in his profession with distinction. He campaigned on our Western Frontier, in Cuba and the Philippines. He took part in the Moro campaigns in Mindinao and Jolo. In 1905 he commanded the Datu Ali expedition. The late Maj. Gen. Leonard Wood chose him as his aid-de-camp in Cuba and in the Philippines, as also did President Theodore Roosevelt and President Taft while the latter was Secretary of War and Provisional Governor of the Islands. After service on the General Staff from 1911 to 1914 he commanded a cavalry patrol district on the Rio Grande and in actions at Cavazas Crossing and Ojo de Agua. In 1917 he was military attaché to Mexico.

During the World War, General McCoy served with the A. E. F., first at headquarters, then in command of the 165th Infantry and later as brigadier general in command of the 63rd Infantry Brigade. Subsequently he was director general of transportation, A. E. F.

In the sphere of diplomacy General McCoy likewise has a notable record. He was chief of staff of the American Military Mission to Armenia, 1919, and of the special mission to the Philippines, 1921; assistant to the Governor General of the Philippines, 1921-1925; director general of the Red Cross and Commander of the American Relief Mission to Japan, 1923. President Coolidge appointed General McCoy to supervise the presidential election in Nicaragua in 1928. The following year he was chairman of the Commission on Inquiry and Conciliation in the Bolivian-Paraguayan dispute. In 1932 he served as the American member of the Lytton Commission of Inquiry in Manchuria. He wears many decorations including the Distinguished Service Medal with oak-leaf cluster.

In the mere recital of General McCoy's service there is tribute, both to the democracy which presents opportunity and to the training and morale of the Army of the United States. In the man there is exemplification of character, ability and zeal. We salute the new commander of the Second Corps area for all that he is and all that he has done and continues to do *pro patria*.

THE present Congress, paying little heed to the few pacifists among its members, has settled the program of our military defense for the coming fiscal year. The War Department Appropriation Bill carrying a total of $572,446,844.00 was approved on May 6th and sent to the President for signature. Of the total appropriated, $383,104,859.00 is for military purposes.

OUR ARMY PROGRAM FOR 1937

The Act contains many notable provisions. It increases the enlisted strength of the Army to 165,000, this to be accomplished through monthly increments of 1500. It authorizes the modernization of 7 batteries of 75-mm. guns and high-speed adapters for more than 325 guns. It appropriates approximately $8,000,000 for seacoast defenses of which $3,000,000 is to be spent at Hawaii, a similar amount on the Pacific Coast, and $750,000.00 in Panama. It authorizes the reëstablishment of Medical Reserve Officers' Training Corps Units. It provides for 125 additional commissioned officers, 50 for the Air Corps, 50 for the Medical Corps and 25 for the Dental Corps. It also provides Army field maneuvers for the training of all components.

Not the least of the wisdom in the new Act was the elimination of a provision, earlier adopted by the House, for the limitation of profits to 10 per cent on all contracts for the production of ordnance and aircraft material. This proposal was objected to by everyone familiar with the production of aircraft and armament. The Assistant Secretary of War, Mr. Harry H. Woodring, stated the objections clearly when he told the Senate Committee such a provision would "1. Greatly increase the complexity and delay of procurement; 2. Stifle research and development; 3. Reduce competition; 4. Give rise to colossal difficulties of administration, and 5. Tremendously increase the cost of checking the books of contractors and necessitate the employment of many more cost accountants than have heretofore been employed on Government contracts".

From a personnel standpoint the Act for the coming year makes liberal provision for Reserve training as well as for the Regular establishment. Approximately one out of every three assignable Reserve Officers may be given some form of active duty during the fiscal year. Funds are provided for training approximately 22,900 officers of whom 21,300 will be given 14-day active-duty details, 1000 will receive a year's active duty under the provisions of the Thomason Act, 300 will be given extended active duty at general and special service schools and 300 will be placed on extended active duty with

the Air Corps. Counting the 7500 Reserve Officers on duty with the Civilian Conservation Corps, some 30,000 Reserve Officers all told will receive military training.

The R. O. T. C. appropriation will be $4,558,846.00, an increase of $133,542.00 over last year. Further, 50 Air Corps Reserve Officers will be taken into the Regular Army and it is thought probable that a law will be enacted authorizing 5-year duty details for 1350 Air Reserve Officers.

ALL students of the ordnance problem will do well to give particular attention to Ordnance Field Service Notes in this and the next issue wherein Maj. Raymond Marsh discusses ammunition supply. During the past year this Journal has published serially (and it will continue to publish) the exceptionally clear and unusually important observations Major Marsh has written on the various phases of supply and maintenance organization. Every angle of this great portion of the ordnance system is worthy of intense study.

AMMUNITION SUPPLY

In these pages we are inclined to stress industrial preparedness with all its connotations for the industrial engineer and executive. This, we contend, is a problem of the first order and requires constant stress. However, it would be extremely shortsighted on the part of any proponent of our national defense to minimize the importance of the Field Service function. After all, our engineers and technicians may design and produce the very best equipment the world over but if the organization fails in the supply and maintenance of that equipment the matériel itself might just as well never have been made. In our Ordnance organization the two great divisions of design and production on the one hand and supply and maintenance on the other are corelative; they are of equal importance; both demand continued analysis and study in even measure. In our Ordnance Department today both functions are splendidly managed, excellently staffed and unusually proficient in their respective fields.

We believe that Major Marsh in his treatment of ammunition supply touches upon the very crux of ordnance effectiveness. Obviously such opinions as he expresses in his text are personal views and do not represent official policy on the subject. We commend the text to readers for the soundness of its approach and the value of its conclusions, stressing as they do that ammunition in time of emergency presents a problem of the first magnitude for those who must produce it and those who must deliver it where, as and when needed.

WE pause to pay heartfelt tribute to the memory of Col. Beverly Wyly Dunn, U. S. Army, Ret., distinguished ordnance expert and charter member of the Army Ordnance Association, who died at his home in New York City on May 10, 1936, at the age of 75. He held high place in the affections of everyone who is familiar with ordnance in the United States and his name will be recorded in the vanguard of those military and professional engineers who have rendered great service to their country. Colonel Dunn, a native of Clinton Parish, La., was graduated from the United States Military Academy in 1883. Throughout the thirty years of his continuous active service in the Army and until his retirement in 1913, he was an officer of the Ordnance Department. We might cite many instances of his talent and leadership during his long service but we select only three of them as showing the distinction he achieved and the high quality of his ability.

COL. BEVERLY WYLY DUNN

At the beginning of this century military chemists were searching for a satisfactory high explosive. Colonel Dunn (then Major) was an observer of the tests of explosives at Sandy Hook Proving Ground. Here he developed a form of impact-testing machine which was used to test all available samples of explosives rather than risk the destruction of a gun by trial firing As a result of tests Major Dunn selected ammonium picrate as the explosive which seemed to possess sufficient power while having least sensitivity. He recommended that the explosive be tested at the Proving Ground.

The results were favorable and it was adopted for service. In order that the composition of the substance might be secret it was officially designated as Explosive "D", the letter "D" being the initial letter of the name of its proposer; unofficially it was known as "Dunnite". At the same time Major Dunn, carrying on the development work of the then Capt. W. S. Peirce (later Brigadier General) and assisted by the staff at Frankford Arsenal, projected a detonating fuze which was powerful enough to detonate such an insensitive material as ammonium picrate yet which could withstand the shock of impact on armor.

Colonel Dunn was also instrumental in developing the War Department's powder factory at the Picatinny Arsenal. In 1906 the Congress appropriated funds for the erection and equipment of a powder factory. The selection of Picatinny Arsenal was recommended to the Chief of Ordnance by a board of officers, and after approval by the Secretary of War, the work of preparing the plans was originally assigned to Major Dunn who took command of the powder depot. Shortly thereafter he was engaged by the American Railway Association to organize the Bureau of Explosives. This Bureau was established in 1906 by the Association for the safe transportation of explosives. In the early part of the century the railroads would not accept dynamite for shipment but with the increase in the use of explosives, particularly after 1900, efforts were made by manufacturers to change their rules. The first set of regulations governing such shipments was prepared by Dr. Charles B. Dudley, and in 1905 Colonel Dunn was designated by the Government to act as an advisor to this group. In 1907 he became the chief inspector of the Bureau, organized a corps of technicians to instruct manufacturers and railroad officials in the proper observance of the rules for safe transportation of explosives, investigation and elimination of accidents. The success of the Bureau under Colonel Dunn's direction was so great that he was asked to take charge of the Bureau permanently. In 1911 he retired from the Army to devote his entire time to this important work. He served continuously as head of the Bureau until his death.

Here was a life work that was not spectacular. And he would have it so, but as an Ordnance officer for seventeen years and as a director of safety in transportation for nearly thirty years, his was an achievement of the very highest order which will endear his memory to all who knew him as the very capable executive, expert engineer and kindly gentleman that Beverly Wyly Dunn, late a colonel of Ordnance, was.

The Nationalization of Munitions, I—Background

An Editorial

IF nationalization (government ownership) of the production of armament in the United States would contribute one iota to the elimination of the scourge of war we—and all others with only a modicum of horse-sense—would be heart and soul for it. Every one of the 125,000,000 of our people who uses his reasoning rather than his emotions in forming his judgments would be for it. We would be for it even if it were not quite a 100 per cent guarantee of peace provided it did not materially jeopardize our own potentiality for defense. But as nationalization would not, by the weariest stretch of the imagination, eliminate war and as it would most decidedly threaten our own security by ultimate defeat whenever war might come, we oppose any such proposal today just as definitely as it has been opposed in the past and we will continue to oppose the proposal or any modification of it in future.

In this series of editorial studies of the subject, which will continue through several issues of this journal, it will be our purpose, first to present some of the background which antedates the present revival of the discussion. The proposal is by no means new. It has been urged at one time or another for its alleged economic value, its alleged effect on the elimination of war, and its alleged assurance of adequate preparedness. Naturally enough, sincere students have examined the proposal and always have concluded that the game is not worth the candle. Hence before taking up the findings of the majority of the special committee appointed to investigate the munitions industry—the majority having recommended nationalization—it is well, we think, to review what had taken place before the great Senator Nye left his native wheat fields of North Dakota to become the Sir Galahad who would slay the munitions demon.

We will go back no further than the period of the World War in amassing our array of facts. Nationalization of the arms industry was advocated quite vociferously in 1913 and 1914. Those were the days when another silver-tongued orator, perfectly oblivious to the arms problem, very foolishly declared that in our country a million men could spring to arms overnight. While he was saying that, incidentally, Dr. David Starr Jordan, then advocate of nationalization, was saying that wars were things of the past.[1] Fourteen years before the same thing was said.[2] There was the same sort of ballyhoo about arms production nearly a quarter of a century ago, and if we were to go back further we would find it at recurring intervals as far back as the days of Aristophanes, 300 B. C. But with the World War raging in Europe, and prior to our entry into it, the question of nationalization was fomented strenuously. And it was studied seriously by qualified experts to determine its feasibility. What happened is very interesting. On June 3, 1916, the Congress adopted our first National Defense Act. Section 121 of that Act read as follows: *"Investigation as to Government manufacture of arms, and so forth*—The Secretary of War is hereby authorized to appoint a board of five citizens, two of whom shall be civilians and three of whom shall be officers of the Army, to investigate and report to him the feasibility, desirability, and practicability of the Government manufacturing arms, munitions, and equipment, showing in said report the comparative prices of the arms, munitions, and equipment manufactured in Government plants and those manufactured in private plants, the amount of money necessary to build and operate Government plants for the manufacture of arms, munitions, and equipment; showing also what the Government plants and arsenals are now doing in the way of manufacturing arms, munitions, and equipment, and what saving has accrued to the Government by reason of its having manufactured a large part of its own arms, munitions, and equipment for the last four years. And the Secretary of War is hereby directed to transmit said report to Congress on or before January first, nineteen hundred and seventeen."

> *ARMY ORDNANCE will publish in this and succeeding issues a series of editorial studies on the Nationalization of Arms Production. It has been proposed from time to time over many years that the manufacture of armament be made a government monopoly. The most recent recommendation to this end was made by a majority of members of the special committee appointed to investigate the munitions industry under the chairmanship of Senator Gerald P. Nye of North Dakota. A minority of the committee opposed government monopoly. In order that the complete record of this all-important topic, the arguments pro and con and the fallacies of such an undertaking may be available to interested students of the subject, these editorial studies will present what* ARMY ORDNANCE *believes to be the only logical approach and sound conclusion on the proposal.*
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> *Copies of these editorials will be available for complimentary distribution to anyone who would like to have them.*—EDITOR.

THIS board, later known as the Kernan Board, consisted of the following: Col. F. J. Kernan, 28th Infantry, President; Lieut. Col. C. P. Summerall, F. A.; Mr. Benedict Crowell, Mr. R. Godwin Rhett and Maj. L. M. Fuller, U. S. Army, Retired, recorder.[3] We quote one appropriate part of the findings of the Board, after exhaustive study, and the Board's summary:

"No feature of the board's experience is more impressive

1. "What shall we say of the Great War of Europe ever threatening, ever impending, and which never comes? We shall say that it will never come. Humanly speaking it is impossible"—Dr. David Starr Jordan, "War and Waste," 1913.

2. "There will be no war in the future, for it has become impossible now that is is clear that war means suicide."—I. S. Bloch, "The Future of War," 1899.

3. Colonel Kernan, later major general, organized and commanded the Services of Supply, A. E. F., November 1917 to July 1918 and served as technical military advisor to the American Commission to Negotiate Peace at Paris. Lieut. Col. Charles P. Summerall, later General Summerall, subsequently became commander of the First Division, of the 5th, 9th and 4th Army Corps, A. E. F., and, from 1926 to 1930, Chief of Staff of the U. S. Army. Mr. Crowell later became the Assistant Secretary of War and Director of Munitions during the World War and a brigadier general in the Ordnance Reserve Corps. Mr. Rhett, while serving on the Board, was president of the Chamber of Commerce of the United States.

than the attitude of private manufacturers to this whole question of preparedness. It is clear that the enormous difficulties they themselves have experienced in arriving at successful production, combined with the extraordinary size of the foreign demand, has made such a lasting impression that the carrying on of modern war is a task of stupendous magnitude and of extreme difficulty from every angle. They are more than willing to coöperate; they are anxious to do so, fully realizing that in successful coöperation with the Government lies the best if not the only certain chance of success. Apprehension has been expressed that Government contracts and a potential capacity to turn out war material might foster the growth of a class whose profitable interests would lie in war, and who, in consequence, might in time become a danger to the State. It is not the belief of this board that any such danger exists in our country. The number of plants and of persons concerned, when considered in reference to the whole country, the total of industrial plants and of people, is relatively too insignificant. We know the function of the leaven in respect to the mass; but we know, too, that the mass must be adapted to the particular leaven if anticipated results are to follow, and it is impossible to believe that we constitute a mass responsive to a leaven of war-like provocation and ready to belie our strongest characteristics by taking on, under the workings of an insidious few, the nature of a war-seeking people. . . .

"On the other hand, we can not fail to realize that the danger of a national catastrophe through a lost war is a real danger which we have to provide against, and only through such coöperation with private industry can it be practically done."

In conclusion the board summarized its findings and recommendations as follows:

"1. It is not desirable that the Government manufacture its arms, munitions, and equipment exclusively.

"2. It is not feasible or practicable for it to do so, with any due regard to economy or to preparedness within a reasonable time.

"3. It is desirable that the Rock Island Arsenal be enlarged promptly and considerably, especially for the increased production of rifles.

"4. It is desirable that modern machinery and appliances be installed in all arsenals where needed.

"5. It is desirable to arrange with private industry for a portion of the supply of whatever reserves of arms, munitions and equipment are determined upon with due regard to the conversion of their plant to use in such connection in time of war.

"6. It is important to take into consideration the location as well as the organization of plants which are coördinated, with a view both to safety and facilities for distribution.

"7. It is important to accumulate at least a year's supply of all raw material which is needed in the manufacture of arms, munitions, and equipment and is not to be found within the continental United States.

"8. It is important to accumulate a full supply of drawings and gages sufficient to enable all coördinated industries to work to full capacity promptly.

"9. It is desirable to standardize gages, jigs, and tools as far as practicable and as soon as practicable.

"10. It is exceedingly important that skilled and experienced labor in coördinated industries especially be enrolled, and in the event of war enlisted for work in selected factories.

"11. It is important that a comprehensive plan of organization for prompt expansion to full capacity, night and day, both in Government plants and in those of coördinated private industries be worked out and made ready for immediate use.

"12. It is important that the Government establish plants for the assemblage of field-gun ammunition at such points as may be best adapted thereto, with due regard to safety and facility for distribution.

"13. It is exceedingly important that our arsenals equipped for the manufacture of rifles and artillery be put to work at full capacity as early as possible."

NOW let us examine what acknowledged authorities—not theorists—have said on the subject. Let us quote some of the recognized authorities. The Director of Munitions during the World War, Brig. Gen. Benedict Crowell:—"When the war touched us our strategical equipment included plans ready drawn for the mobilization of men. There were on file at the Army War College in Washington detailed plans for defending our harbors, our coasts, and our borders. There were also certain plans for the training of new troops.

"It is worthy of note, however, that this equipment included no plan for the equally important and equally necessary mobilization of industry and production of munitions, which proved to be the most difficult phase of the actual preparation for war. The experience of 1917 and 1918 was a lesson in the time it takes to determine types, create designs, provide facilities, and establish manufacture. These years will forever stand as the monument to the American genius of workshop and factory, which in this period insured the victory by insuring the timely arrival of the overwhelming force of America's resources in the form of America's munitions."

The Chief of Ordnance, U. S. Army, during the World War and for twelve years thereafter, Maj. Gen. C. C. Williams:—"The part of those in the government service is to keep always alive an interest and knowledge of the scientific, engineering and industrial processes incident to the manufacture of weapons of war. Orders for ordnance material should, as far as practicable, be placed with private concerns so that the engineering staffs and workmen of these concerns may be skilled in the design and production of war munitions. Intimate relations must be established with engineering societies and ordnance problems discussed in the technical meetings of those societies. . . . The responsibility for the solution of the ordnance problem rests not alone upon the nation but upon the nation's industries as well, and it is only by most effective coöperation that we can hope to attain adequate results."

"A satisfactory plan of industrial preparedness requires that a considerable number of factories have the necessary knowledge and experience to produce ordnance and ordnance supplies of the latest types so that they may be familiar with the work required in case of a national emergency."

The first Chairman of the General Munitions Board, 1916, and first Chairman of the War Industries Board, 1917, Col. Frank A. Scott:—"A trained staff tends to develop traditions and a technique difficult to jettison when they do not fit the need. Preconceived plans, worked out in peace time, may become obsolete and the obsolescence remain unrecognized until the emergency arises, and then we will develop contentions and lose time. Shall we adhere to our plan, or shall we alter it? Peace-time plans will necessarily contemplate the use of many peace-time methods and much peace-time machinery, and these could be, and would be, vastly improved

under the stress of war. A poorly laid out plan, or an unbalanced piece of organization machinery may prove more of an obstacle to progress than a clean sheet and a clear road. These are some of the arguments that readily occur to one. We have, to refute them, the whole, long, ghastly story of our failures and losses in previous wars when we depended on the 'chuck and chance it' method of preparation."

The Chief of Ordnance, U. S. Army, 1901-1918, Maj. Gen. William Crozier:—"The industrial preparation for war has been segregated, and placed under the charge of an able and energetic Assistant Secretary of War; the country has been divided into manufacturing districts, as you have recently been told at an engineering meeting in New York. It is hoped that the manufacturing establishments in each will fit themselves for the production of special articles of munitions which are designated to them as most appropriate for their particular equipment. The manufacture of small quantities of these articles, under trial orders, will not usually afford any profit, and will undoubtedly require time and care and attention for which a return cannot be promised in the form of orders in quantity in time of peace, and of which the irksomeness may only be endured through a sense of duty."

THE Secretary of War, 1921-1925, John W. Weeks:—"Arsenals, however, are not as important to the Army as those plants connected with the steel industry which were developed for specific purposes during the war. Now that the war is over the owners of these plants find them to be serious burdens. Generally speaking, they can not be adjusted to the ordinary requirements of the manufacturing industry, and if the country were in a financial position to warrant the expenditure I believe we should subsidize those plants and keep them ready for the Government's purposes as we do our arsenals."

The Assistant Secretary of War, 1921-1923, Col. J. Mayhew Wainwright:—"To a large extent, munitions are special in nature and not comparable to commercial peace-time production in general. While uniforms, food, shoes, bedding and other materials necessary for the maintenance and welfare of an individual are the same in time of war as in time of peace, munitions, which are the controlling factor in the utilization of a nation's energies in war, are not comparable to peace-time material. On the other hand, in time of war the nations's industries must be diverted from their normal production methods and materials. I emphasize this to show how important it is in time of war for the Government to be able to depend on the industries to assist in such times of stress."

The Commanding General of the Services of Supply, A. E. F., and later Chief of Staff of the U. S. Army, Maj. Gen. James G. Harbord:—"Our problem of industrial preparedness cannot be divorced from the remainder of the National Defense. You will need a balanced defense—for trained men without munitions, and munitions without trained men are equally helpless. Five years ago our Congress approached the problem of national defense with great patriotism and intelligence, and worked out the best scheme for it that our country has ever had. It included provision for both man power, and the machinery for enlisting our great industrialists in the mobilization of business."

THE late chairman of the Westinghouse Electric and Manufacturing Company, Assistant to the Chief of Ordnance during the World War, Brig. Gen. Guy E. Tripp:—"It has been the policy of the United States—in fact it has been a matter of law—that such articles of war as are not regularly manufactured in its arsenals must be procured in the open market. No provision has ever been made which guarantees that the open market is capable of producing the articles so required. This has now been demonstrated to the vast disappointment of the believers in the million-men-over-night idea and its concomitant fallacies.

"It is not conceivable that those who preach unpreparedness would conduct their own business on such lines. It is unbelievable that they would ask their man-of-all-work to mow the lawn, knowing well enough that they themselves had locked the lawn mower in the toolhouse, unless they imagine that by providential intercession, munitions of war come into being in the manner in which Elijah achieved food—through the courtesy of some friendly ravens."

The former Chief of Staff of the U. S. Army, Gen. Charles P. Summerall:—"We know too well the staggering problem presented to us about munitions in the initial days, the initial months of the war. It was the experience everywhere. Paris was protected with all of the power of France not because it was the capital or the chief city—if those had been the only reasons Paris could have been abandoned. The heart of the munitions industry of France was in Paris and its environs. If Paris were lost munitions would cease to exist and the war would come to a speedy end. Several reasons have been given why the German army failed in its initial campaign, which should have been successful; and more and more it is coming to light that munitions, and not the lack of men, was the reason for the great defeat in the first Battle of the Marne. It is true the world over, it is true with us, and we must not for one moment ignore the fact that munitions—not men—are our great problem in modern war; we have the men and we can get them, but we have not the munitions and we cannot get them unless we are prepared to supply them."

The Secretary of War, 1925-1929, Col. Dwight F. Davis:—"We are not planning for war. We are planning against war and to guarantee an honorable peace, a righteous peace. Preparedness for self-defense is an inalienable right as old as the human race. Self-government and self-protection constitute the keystone of the arch of an enduring democracy. The combination of a weak and wealthy nation has never existed for any length of time in history. Like fire and floods, war is not a cause but an effect."

THE Assistant Secretary of War, 1925-1928, Col. Hanford MacNider:—"The major endeavor and the one with which you are most concerned is not the question of current supply but the plans for a possible emergency. You can see, however, how important it is that our small but basic organization be of sound character. Secretary Davis has told you, at not such a distant date, of our plans for industrial preparedness—the tangible way in which industry is preparing to meet the issue—the great survey of raw materials, factories, transportation, labor, power, of the allocations already made, of the great commodity committees at work, of the education of both regular and reserve officers, the civilian groups in the various procurement districts, the arrangements for credits—of all the ramifications which united will give definite assurance that we can all go to work when the bell rings with a real program of intense and intelligent production."

The Assistant Secretary of War, 1930-1933, Frederick H. Payne:—"But an army without munitions would be at the mercy of its foe. Consequently, the steps I have so briefly outlined with respect to procurement planning are vital responsibilities of government. They may be the determining factor if we are drawn into another major conflict. The ability of a part of American industry to turn promptly, in emergency, from normal pursuits to the manufacture of munitions of war is essential to our national security."

The chairman of the Committee on National Defense, U. S. Chamber of Commerce, Mr. Ernest T. Trigg:—"But the weak spot in our industrial preparedness is the training of the managers and workers of our factories so that when called upon they can begin producing war material with maximum rapidity. This weak spot can and should be remedied by educational orders being let out to industry in time of peace.

"We do not have in this country any large privately operated munitions industry, as do some of the countries of Europe. Our Government arsenals have a maximum capacity to produce only from one-half of 1 per cent to 10 per cent of the total requirements in time of war of the various articles of ordnance equipment. For many indispensable articles, therefore, we must rely in war time upon commercial plants which have no experience in peace with their production."

DIRECTOR of the Council of National Defense, 1919-1920, Grosvenor B. Clarkson:—"The majority of persons still think of war only in terms of troops and waving flags. They still think that appropriating for an army and navy ends the duty of Congress. It is not true. Modern war means the linking of industry and science to the military needs, and, lest there be almost criminal waste of money and loss of life, the linking must be arranged for before and not after the actual need. In armed conflict today there can be no preparation when the fight is on, for preparedness now is a scientific thing, and scientific application precludes haste.

"Modern war—and every American should get this well into his head—means, in its practical working, the utilization of all of the industries in one form or another, to say nothing of the lay citizenship of a country. Howard Coffin, that automobile engineer out of the West who was the pioneer protagonist in this country of industrial preparedness, has said: 'Twentieth-century warfare demands that the blood of the soldier must be mingled with from three to five parts of the sweat of the men in the factories, mills, mines, and fields of the nation in arms.' "

The War Policies Commission: [4] "In time of peace continuous planning by the Federal Government, particularly by the War and Navy Departments, should be directed toward insuring:

"(1) That upon declaration of war there shall be immediately available to the Congress accurate and detailed estimates concerning the man power and material needs of the military and naval services, together with detailed studies and recommendations concerning the most applicable methods for mobilizing the necessary men and procuring the required munitions. (2) That there shall be no competitive bidding between Government agencies for the products of industry. (3) There shall be no placing of contracts in excess of needs. (4) That cost-plus percentage methods of purchase shall be eliminated. (5) That the munitions production load shall be distributed properly over the United States. (6) That the governmental organization required in the administration of war functions shall be set up promptly. (7) That the necessary controls respecting prices, raw materials, transportation, priorities, war trade, finance, and related matters shall be continuously studied, so that in the event of war the will of Congress may be promptly and efficiently administered."

The Secretary of War, George H. Dern: "As I have said before on numerous occasions the experience of this nation as well as that of others forces me to the conclusion that in the event of war the major portion of our military supplies would have to be produced by private industry. It would be suicidal to depend on government-owned plants alone. . . . It is therefore highly desirable that in time of peace industry should produce some war supplies, because any plant that has once produced such articles is thereafter better qualified to produce them more speedily in time of war. In brief our vital industrial problem in war is to produce the necessary war supplies and to do it first, so that our enemy can gain no advantage from our shortage. Time is the vital element. This fact cannot be repeated too often. This government will be placed at a serious initial disadvantage if it is forced to turn to an industry entirely unfamiliar with the production of munitions."

The Assistant Secretary of War, Harry H. Woodring: "I am forced to the conclusion that this country must look to its great private industry for the supply of munitions. In order to make our national defense effective, private industry must be sufficiently flexible to adapt itself to the production of war materials soon enough after the opening of hostilities. It follows that American industry should be prepared to perform its war mission. This means that industry should be given munitions work in time of peace, for any plant that has once produced munitions is thereafter better qualified to produce the same munitions in war. I feel impelled to emphasize the importance of obtaining legislation which will permit the War Department, in time of peace, to place educational orders, so that selected industries may actually produce, before the emergency arises, a limited amount of the kind of matériel assigned them for war manufacture. Under the present laws requiring competitive bidding, no assurance can be given that any selected plant could receive such educational orders. If industry is to be expected to get into quick production of war materials, some assistance of this nature must be given by the War Department in time of peace."

These, then, constitute some of the qualified opinion on this subject during and since the World War. Over and above them all stands the provision of the National Defense Act of 1920 which definitely looks to private industry to produce all the things needed for the defense services in time of war. By its terms it acknowledges that private industry is the only way, assured and successful, by which we can hope to arm our defenders whenever war may come. But this is merely background and in succeeding studies of this series we will present a factual rebuttal giving the reasons against each item of the Munitions Committee majority report why any national policy for the elminiation of private production of armament in time of peace is sheer humbug because such a policy would be a *carte blanche* guaranty that we will be licked if we ever have to fight again. And victory, when one must fight, is the only thing worth while. (*To be continued.*)

4. The members of this Commission were: Patrick J. Hurley, Secretary of War, Chairman; Senator David A. Reed, Vice Chairman; Senator Joseph T. Robinson; Senator Arthur H. Vandenberg; Senator Claude A. Swanson; Congressman John J. McSwain; Congressman C. F. Adams; Congressman William P. Holaday; William D. Mitchell, the Attorney General; Robert P. Lamont, Secretary of Commerce; Arthur M. Hyde, Secretary of Agriculture; W. N. Doak, Secretary of Labor.

Association Affairs

DIRECTORS' MEETING

THE annual meeting of the Board of Directors of the Army Ordnance Association was held in the city of Cleveland, Ohio, on March 21, 1936. Preceding the meeting, a luncheon was given by Brig. Gen. Benedict Crowell, president, and Col. Frank A. Scott, director, in compliment to the officers and Advisory Board of the Cleveland Ordnance District. The luncheon and meeting were held at the Union Club. The following extract from the minutes of the meeting is published for the information of all members:

The first business to come before the meeting was the report of the treasurer for the year 1935. In the absence of the treasurer, his report was presented by the assistant treasurer who reported as follows:

Cash on hand and on deposit January 1, 1935, was $7,373.10. Receipts from all sources during the year were $18,385.08. Expenditures for all purposes during the year were $21,945.72. Cash on hand and on deposit December 31, 1935, was $3,812.46. Excess of cash expenditures over cash receipts for the year with all bills paid was $3,560.64.

Despite the excess of cash expenditures over cash receipts there was an increase in the Association's operating reserve of $1,547.94, being the increase in value of securities, which increase amounted to $5,603.75. There was no change during the year in the number and kind of securities in the Association's investment account. The market value of these securities December 31, 1934, was $21,338.75 and December 31, 1935, $26,942.50.

In accordance with the custom of past years, the accounts of the Association for the year 1935 were audited by Messrs. Ernst and Ernst, certified public accountants. The audit was as of December 31, 1935, the last previous audit having been made by the same firm of accountants as of December 31, 1934. Certified copies of the audit report are available for the information of trustees and directors. The treasurer's report was accepted with thanks and approved. (A letter sent to all members of the Association, February 1, 1936, included a summary of cash receipts and expenditures.)

The next order of business was the annual report of the executive secretary. Copies of the report in full were available for all officers, trustees and directors. After discussion the report was approved as submitted. The budget of expenditures recommended for 1936 was approved.

The next order of business was the appointment of one director who, in accordance with Article IV, Section 4, of the Constitution of the Association, shall serve as a member of the Board of Trustees. Col. James L. Walsh, a director, having served in this capacity since the incorporation of the Association in 1929, was elected to membership on the Board of Trustees for the term to expire December 31, 1936.

After discussion trustees and directors recorded their approval of the policies and activities of the Association with especal reference to the editorial policy of ARMY ORDNANCE during the past year and directed that the same policies be continued. The President was authorized to make such arrangements as he may consider advisable for the annual meeting of the Association during 1936 and that the appointment of the necessary committees for the award of medals be left to his discretion. This was the seventeenth annual meeting of directors and trustees.

LOS ANGELES POST

A NEW post of the Army Ordnance Association will be established at Los Angeles, Calif., on May 27, 1936. The inaugural meeting, preceded by dinner, will be held at the University Club, Los Angeles, at 7:30 P. M.

This will be the twelfth local chapter of the Association. Its territory is carved out of portions of the present California Post with headquarters in San Francisco and of the St. Louis Post. San Francisco has ceded to the new post the lower part of Southern California including the counties of San Luis Obispo, Kern and San Bernadino and all counties south thereof, while St. Louis has relinquished the states of New Mexico and Arizona. All members of the Association resident in this area are now eligible for membership in the Los Angeles Post. Steps are now being taken to change the name of the present California Post to the San Francisco Post.

All praise for initiating the new organization goes to Capt. Philip Schwartz whose untiring energy, with the coöperation of members in Southern California, brought about preliminary activities. In the next issue of ARMY ORDNANCE an account of the inaugural meeting will be published together with a short biographical sketch of the officials of the new organization. Our local chapters offer splendid opportunity for professional and social contact and it is to be hoped that all members resident in the territory of the new post will affiliate with it and that its program of activities will be a stimulus to ordnance progress in that important section of the country.

ARMY ORDNANCE ASSOCIATION SCHOLARSHIP KEYS

IN accordance with the practice adopted several years ago, the Association is awarding again this year to the honor students of Ordnance Units of the Reserve Officers' Training Corps the Ordnance Key for proficiency in scholarship. These honors are usually conferred at the end of the scholastic year. Accounts of the awards at various institutions will be published in these columns. Thus far the awards have been made at University of Cincinnati, Stanford University and University of California.

The award of Ordnance keys at University of Cincinnati was included on the program of the military convocation held in Wilson Auditorium February 5th. All R. O. T. C. Units of the University were in attendance at the ceremony at which the President of the University, Dr. Raymond Walters presided. Others in attendance included Dean Schneider, Dean of the College of Engineering and Commerce; Lieut. Col. Hawley Swift, President of the Cincinnati Reserve Officers' Association; Lieut. Col. J. R. Stewart, Liaison Officer between the Reserve Officers' Association and the R. O. T. C. Unit; Col. C. L. Harrison, Chief of the Cincinnati Ordnance Procurement District; Lieut. Col. Oscar Krupp, Ord. Dept., U. S. A.; Maj. A. Zerbee, F. A., U. S. A.; Majors R. Anderegg and F. Miller, Ord. Res.; Maj. Lawrence C. Mitchell, C. A. C., P. M. S. & T.; the honorary colonel and lieutenant colonel of the R. O. T. C. Unit; and the members of the Guideon, an honorary sorority composed of young ladies interested in the welfare of the Unit.

The Ordnance keys were presented to the recipients by Colonel Harrison. Cadet Hugh Van Valkenburgh, a pre-junior in the College of Engineering and Commerce, received the senior award. He is a resident of Chicago and a student in chemical engineering. He formerly attended Morgan Park High School, Chicago. His average military grade up to and including the first term of his pre-junior year was 93.1 per cent.

Cadet Charles George Sattler, a junior in the College of Engineering and Commerce, also a chemical engineering student, was awarded the junior key. His average military grade for the second term of his pre-junior year and first term of his junior year was 89.5.

The two keys at Stanford were awarded to Charles L. Lipp-

man and John H. Moller. The presentation was made by Brig. Gen. Sherwood E. Cheney, commanding the 9th Coast Artillery District, on April 13, 1936, at the annual inspection and review of the cadet corps of Stanford University.

Mr. Lippman, of Whittier, Calif., is a senior in the school of mechanical engineering and has an excellent academic record, being a member of Phi Beta Kappa honor society.

Mr. Moller is a junior in the school of electrical engineering. His home is in Fairfield, Calif.

At University of California, keys were awarded to Lloyd R. Zumwalt and Hugh D. Burnham at the President's Review on April 30th. Maj. Gen. David P. Barrows, Commanding General, 40th Division, National Guard, the reviewing officer representing President Sproul, presented the awards.

Mr. Zumwalt, 5659 Carberry Ave., Oakland, Calif., is a member of Phi Beta Kappa; Distinguished Student in Military Science; Honor List, Military Department; and honorary Lieutenant Colonel.

Mr. Burnham, 2923 Kelsey Street, Berkeley, Calif., is a member of "Scabbard and Blade", honor military society; Honor List, Military Department; cadet rank, Technical Sergeant—the highest possible for a junior.

Among those in the reviewing stand were: Maj. Gen. James H. McRea, Maj. Gen. Edward M. Lewis, Maj. Gen. Frank L. Winn, Rear Admiral Edward H. Campbell, U. S. N., Commodore George W. Bauer, U. S. N. R.; Brig. Gen. Robert W. Mearns, Brig. Gen. Sherwood A. Cheney, Col. John A. Calkins, Capt. W. G. Barker, U. S. N.; Col. Elvid Hunt, Lieut. Col. Eugene Bennett, Lieut. Col. Floyd W. Stewart, Lieut. Col. Curtis G. Sullivan.

New Members

THE following have recently been admitted to membership in the Army Ordnance Association:

Henry E. Abbott, Philadelphia, Pa.; James B. Allen, New York, N. Y.; Albert F. Austin, San Diego, Calif.; Edgerly W. Austin, Detroit, Mich.; John W. Augustine, Hyattsville, Md.

Roy L. Baber, Beverly Hills, Calif.; John T. Barret, Fort Smith, Ark.; W. C. Beschorman, New York, N. Y.; E. J. Biever, Kohler, Wis.; Adrian G. Blanchard, Oneonta, N. Y.; W. Russell Borneman, Pottstown, Pa.; George C. Brainard, Youngstown, Ohio; A. E. Buchanan, Jr., Bridgeport, Conn.; Morden Buck, Rochester, N. Y.; A. D. Bullerjahn, Milwaukee, Wis.; D. H. Byerly, Middletown, Conn.

F. W. Caldwell, E. Hartford, Conn.; T. W. Carlisle, Cleveland, Ohio; R. W. Clark, Bridgeport, Conn.; R. O. Cragin, Los Angeles, Calif.; G. S. Crane, Milwaukee, Wis.

David Dardick, Brooklyn, N. Y.; Austin W. Day, Washington, D. C.; William Detsch, Kohler, Wis.; John J. Dooley, New York, N. Y.; Fred J. Douglas, Utica, N. Y.

A. L. Ellis, Deep River, Conn.; H. H. Erkelenz, Milwaukee, Wis.; George J. Evans, Waterloo, Iowa.

Henry N. Flynt, Greenwich, Conn.; Walter V. Ford, Jeannette, Pa.

C. F. Garesche, New York, N. Y.; C. A. Geatty, New York, N. Y.; C. W. Gesregan, New York, N. Y.; E. B. Gilmore, Los Angeles, Calif.; C. F. Green, Schenectady, N. Y.

I. D. Hagar, New York, N. Y.; W. S. Haines, Hoboken, N. J.; K. Hansen, Milwaukee, Wis.; Sidney M. Harvey, Detroit, Mich.; W. F. Heilman, Milwaukee, Wis.; J. A. Hendley, Middletown, Conn.; Philip W. Henry, New York, N. Y.; H. C. Hettelsater, Milwaukee, Wis.; H. S. Hitchcock, Los Angeles, Calif.; L. S. Hobbs, East Hartford, Conn.; W. John Hoffman, New York, N. Y.; William O. Hotchkiss, Troy, N. Y.; P. R. House, Brooklyn, N. Y.; W. R. Howard, Washington, D. C.; R. B. Hunter, Milwaukee, Wis.; F. L. Hutsler, Beverly Hills, Calif.; Daniel H. Huyett, Reading, Pa.

E. C. Jennings, Minot, N. D.; I. C. Jennings, S. Norwalk, Conn.

J. N. Kelman, Los Angeles, Calif.; Robert Killefer, Los Angeles, Calif.; George E. Kingsley, Los Angeles, Calif.; Roland T. Kinney, Los Angeles, Calif.; M. A. Koffman, Los Angeles, Calif.

Gilbert B. Lamb, Brooklyn, N. Y.; John L. Larsen, Los Angeles, Calif.; Frederick S. Lee, Elimsport, Pa.; George C. Lilly, Bethlehem, Pa.; Charles L. Lippman, Whittier, Calif.; R. G. Lockett, Milwaukee, Wis.; Arno H. Luehman, March Field, Calif.; Irving M. Lynn, Lynchburg, Va.

P. George Maercky, Houston, Texas; James H. Marsteller, W. Lafayette, Ind.; C. J. McCarthy, E. Hartford, Conn.; James P. McNichol, Bryn Mawr, Pa.; Charles F. McReynolds, Los Angeles, Calif.; Charles Meier, Cincinnati, Ohio; H. Menck, Milwaukee, Wis.; R. E. Mills, Milwaukee, Wis.; Alfred J. Miranda, Jr., New York, N. Y.; James F. Monaghan, Waltham, Mass.; H. J. Moore, Middletown, Conn.

R. T. Nalle, Philadelphia, Pa.; F. W. Neilson, Bridgeport, Conn.; L. P. Niessen, Milwaukee, Wis.; E. Scott Norling, Yonkers, N. Y.; K. T. Norris, Los Angeles, Calif.

Oliver G. Olafson, Minneapolis, Minn.

J. Thomas Palmatory, Richmond, Va.; E. G. Peterson, Milwaukee, Wis.; George S. Pines, Chicago, Ill.; Emil Price, Los Angeles, Calif.

Karl D. Reyer, Norman, Okla.; Thomas E. Ringwood, Montauk, L. I., N. Y.; D. W. Robinson, New York, N. Y.; R. M. Roosevelt, New York, N. Y.; William W. Rose, Cleveland, Ohio; T. M. Russell, Jr., Middletown, Conn.; P. Ryan, Milwaukee, Wis.

N. R. Sage, Middletown, Conn.; F. Salditt, Milwaukee, Wis.; Alexander Schein, Brooklyn, N. Y.; M. H. Scorer, Westerville, Ohio; E. W. Seeger, Milwaukee, Wis.; C. R. Seymour, Simsbury, Conn.; Cleve F. Shaffer, San Francisco, Calif.; T. V. S. Skinner, Shanghai, China; A. P. Smith, Middletown, Conn.; Edward J. Soares, Pocatello, Idaho; L. Y. Spear, Groton, Conn.; Roger S. Sperry, Waterbury, Conn.; R. R. Stephens, St. Louis, Mo.; W. C. Stevens, Milwaukee, Wis.; H. S. Strouse, Milwaukee, Wis.; James Suttie, East Chicago, Ind.

J. P. Thornton, Cincinnati, Ohio; H. H. Timken, Jr., Canton, Ohio; H. G. Towner, Washington, D. C.; William E. Turpen, San Francisco, Calif.

Richmond Viall, Providence, R. I.; R. von Schleinitz, Milwaukee, Wis.; Frederic B. Vose, Brooklyn, N. Y.

R. J. Wadd, Milwaukee, Wis.; E. C. Wagner, Los Angeles, Calif.; H. B. Walmsley, Montclair, N. J.; Gustave Walters, Middletown, Conn.; J. C. Ward, Jr., E. Hartford, Conn.; W. F. Washburn, New York, N. Y.; Henry B. Watkins, Westerville, Ohio; James S. Watson, Indianapolis, Ind.; F. U. Webster, Milwaukee, Wis.; G. S. Wheat, New York, N. Y.; G. M. Williams, Middletown, Conn.; Sidney D. Williams, Canton, Ohio; E. E. Wilson, E. Hartford, Conn.; G. W. Wilson, Erie, Pa.; Lester T. Wilson, New York, N. Y.; Michael C. Winetsky, Elizabeth, N. J.; and W. H. Womack, Shreveport, La.

Group Members: Allis-Chalmers Manufacturing Company, Milwaukee, Wis.; J. I. Case Company. Racine, Wis.; Cutler-Hammer, Inc., Milwaukee, Wis.; Ensign-Bickford Company, Simsbury, Conn.; Ex-Cell-O Aircraft and Tool Corporation, Detroit, Mich.; The Frick-Gallagher Manufacturing Company, Wellston, Ohio; Harnischfeger Corporation, Milwaukee, Wis.; United Aircraft Manufacturing Corporation, East Hartford, Conn.; and Wheeling Steel Corporation, Wheeling, W. Va.

Necrology

NOTICE has been received of the death of the following members of the Association: W. W. Atterbury, Philadelphia, Pa.; N. A. Doyle, St. Louis, Mo.; Fred Grau, Spiceland, Ind.; C. A. Ingersoll, Portland, Conn.; H. B. Rust, Pittsburgh, Pa., and L. C. Van Bever, Pasadena, Calif. To relatives and friends of these members Army Ordnance extends condolences.

Ordnance Field Service

AMMUNITION SUPPLY, PART I

By MAJ. RAYMOND MARSH, *Ord. Dept., U. S. Army**

AMMUNITION supply is probably the biggest, the most difficult and the most vital of any problem which the Ordnance Department and mobile field troops must solve. It is the biggest because of its size and the tonnage involved, the tonnage of ammunition exceeding the tonnage of all other supplies put together. It is the most difficult because of the necessity for mobility and the difficulty of cross-country transport in war-torn areas. It is the most vital because without a reliable, uninterrupted supply of ammunition, an army becomes merely a mass of men burdened with voluminous, heavy and cumbersome impedimenta.

In this discussion it is proposed to limit the remarks to ammunition supply. The problem of ammunition procurement or manufacture is a difficult problem, but it is not desired to touch upon those features here. Consequently, it will be assumed, for the purpose of this discussion, that an ample supply of ammunition is available through the appropriate procurement sources and that we are involved now only in the problem of distribution or military supply.

In order properly to understand the ammunition supply problem, it is necessary first to indulge in a little historical research and consider the status of ammunition supply and ammunition supply organizations before the World War, and their development since then. It is, then, desirable to study the present prescribed system of ammunition supply with its organizations, facilities, and distribution and division of responsibility, authority, and control. If our study of the existing system has shown faults and produced criticisms, it is essential that we match our criticisms with constructive and corrective suggestions.

Prior to our entry into the World War, an ammunition supply service, as such, did not exist in reality. The then current edition of the Field Service regulations provided that the organization and operation of the ammunition supply service was a function of the Field Artillery. Tables of organization provided ammunition trains and ammunition columns in divisional and higher organizations, but none were actually in existence. Upon our entry into the World War, new tables of organization were prepared which attempted to put into effect the ammunition supply service as contemplated by our Field Service regulations, but modified more or less by the recommendations of the Allies. Being without any practical experience in such a service, and since it was contemplated that the A.E.F. would operate in more or less direct conjunction with the French, it was only natural and logical that the proposed ammunition service should more or less closely follow the lines of the French method. It was not until April 1, 1918, however, that GHQ of the A.E.F. published any authoritative documents on this subject. On that date, a G-3 study in the form of a memorandum was approved by GHQ and forwarded to the Commanding General, I Corps, for his information and guidance. This memorandum agreed with the provisions of our Field Service regulations and repeated the principle that rear and higher units are charged with the responsibility of pushing ammunition as far forward as possible, thus reducing as much as possible the hauls of the trains of the combatant troops in the lower and more advanced echelons. The shortage of transportation in the A.E.F., among other things, called for material modification of the application of the provisions of this memorandum and finally, the basic principle of supply was reversed and the impetus of ammunition supply came not from the rear to the front but from the front to the rear. Because of these conditions, the methods employed through four years of war by the French, the wide scattering of our units in the early days of the A.E.F., and the many other factors which could be mentioned, ammunition supply in the A.E.F. never attained a uniform procedure. The Commanding Officer of the First Ammunition Train makes the statement that "the First Ammunition Train worked with eleven different artillery brigades and found the method of operation different in each".

INSOFAR as it was possible, it was desired to retain in the division artillery commander the responsibility for the organization and operation of the ammunition supply service in accordance with our Field Service regulations. Nevertheless, conditions forced a modification of this doctrine. A decided change of opinion came about in many divisions as to the suitability of having the artillery handle the ammunition service. In many divisions where the supply section of the General Staff was functioning smoothly, this service was transferred to that section from the artillery, thereby relieving the artillery commander of a very troublesome and good-sized supply function and giving him more time for his tactical duties, which under normal conditions, are very heavy. Under this change, the ammunition supply service was placed under the control of the officer responsible for the other services. Despite the fact that the ammunition supply service was operating smoothly, satisfactorily and efficiently under this arrangement, the change was never officially recognized at any time in the A.E.F., and the Staff School at Langres continued to teach the doctrine that ammunition supply was an artillery function. It is safe to conclude, therefore, that the ammunition service in the A.E.F. never reached a uniform, universally followed method, but was varied from place to place, and in organizations, depending upon local circumstances, individuality, efficiency of individual officers, and smoothness of operation of organizational staffs.

That the ammunition supply service was not wholly satisfactory to everyone, can readily be established by numerous quotations from official reports, and experiences of both Ordnance officers and Artillery officers. The A.E.F. Superior Board on Organization and Tactics, in discussing the ammunition question, conceded that "it has been patent to all familiar with the circumstances that our ammunition supply system has not operated smoothly. The system itself was essentially that in use in other armies and, as shown by their experiences, was not unsound, but we did not seen enough grasp the magnitude of the task involved and provide the large numbers of skilled personnel needed for receiving, sorting and issuing this ammunition at the dumps, and for forwarding it to the guns. Moreover, we did not provide an adequate number of well-equipped dumps." Despite the fact that this conclusion had been earlier recognized and accepted by everyone, it was not until November 1, 1918, that the necessity for improving the ammunition supply service was recognized by the A.E.F. officially. On that date, GHQ approved Table of Organization No. 242, authorizing an ammunition supply company of six officers and 216 men for each combat division.

After the Armistice, the above mentioned A.E.F. Superior Board on Organization and Tactics took up, among other things, the question of the proper organization of an ammunition supply service. The Chief Ordnance Officer of the A.E.F. submitted to this Board certain conclusions which are worthy of repetition

*This discussion presents the personal views of the author and does not represent any official policy on the subject.

here. Those conclusions, which he claimed were justified, were:

"1. The ammunition supply is entirely separate from the supply of other material.

"2. All personnel charged therewith must be well trained in ammunition in time of peace if the service is not to fail in active operation.

"3. Thorough training in ammunition can logically be given at ammunition depots of the Ordnance Department.

"4. In order properly to operate Ordnance ammunition depots, a very considerable force of Ordnance officers and enlisted men must, in any event, be given such training.

"5. By using a large part of these trained men for ammunition trains and ammunition dump personnel, two purposes will

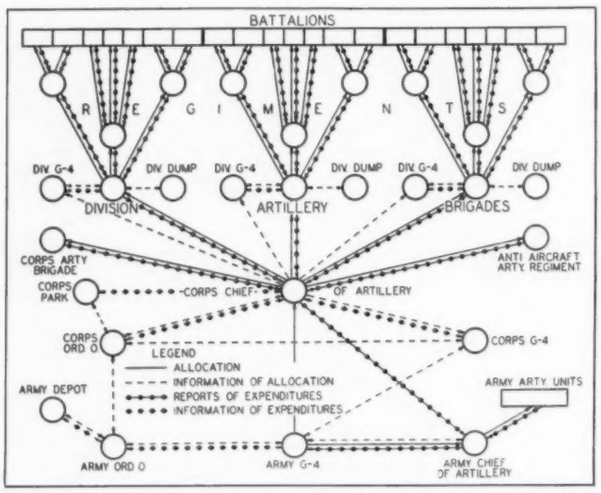

Fig. 1. Functions of the Ammunition Supply Service

be served, with a consequent reduction in the total peace-time requirements for personnel, and in the civilian payroll, at ammunition depots."

These conclusions, while considered by the A.E.F. Superior Board, were not adopted by them, and their recommended organization, as modified a year or so later by a committee of the War Plans Division of the War Department, set up an ammunition train in the division as an integral part of the artillery brigade, and provided that infantry ammunition should be carried in the division quartermaster train, and further that the corps ammunition train should be an artillery train.

THE basis of our present Army organization being the report of this A.E.F. Superior Board on Organization and Tactics, modified as indicated above, it is appropriate to quote such portions as pertain to the ammunition supply service.

"48. *Ammunition Supply.* The system of ammunition supply in vogue in our army during this war is, in general outline, as follows: The Chief of Artillery of an army estimates the ammunition needed for any definite project, as well as for average daily consumption, and shows the amounts to be held in army dumps, in corps and divisional dumps and with batteries. G-4 of the army has a call made for this ammunition from the rear. It is moved up to the army dumps and credits are given corps artillery commanders to cover allotments for definite projects, or to keep dumps and troops supplied up to the regular authorized allowances. Corps artillery commanders allocate ammunition to the divisional artillery commanders and to the corps artillery, to meet their daily or extraordinary needs; and divisional artillery commanders, similarly, allocate to regimental commanders the ammunition for distribution to batteries. G-4 of the army has control of the receipts of ammunition at army depots and its issue therefrom, while corps and divisional artillery commanders have control of the ammunition in their own dumps.

"As for transportation, the corps artillery commander is responsible for the movement of ammunition from army dumps, and arranges with divisional artillery commanders the details of distribution, sometimes hauling by means of corps ammunition train to corps dumps, and sometimes direct to divisional dumps, as might be most convenient. Similarly, divisional ammunition trains sometimes are required to haul from corps dumps only to divisional dumps, and then again to make the haul direct through to the batteries. Regimental combat trains have habitually drawn from divisional dumps. The whole system is necessarily very flexible, its operation depending largely upon the situation of the moment, the ruling consideration being to avoid double handling of ammunition wherever possible. Where light railways are available, the corps artillery commander arranges with G-4, and his transportation agents, for such assistance as can be given; but the movement, at least from corps dumps forward, has generally been by the trucks of the corps and divisional ammunition train, and by the caissons of the regimental combat train. . . .

"49. It being assumed that it is the function of G-4, GHQ, to get the necessary quantities of ammunition forward to army dumps, an analysis of the essential elements involved in distributing ammunition from army dumps to guns may be made as follows:

"(a) To get the ammunition deployed into corps and divisional dumps so as to relieve congestion at army dumps, and so as to facilitate rapid distribution when emergencies arise.

"(b) To regulate distribution from these corps and divisional dumps so that only the absolutely necessary amount of ammunition is scattered in battery positions, thus enabling the higher artillery commanders to check waste and distribute the ammunition to meet the requirements of combat.

"(c) To select sites for dumps, on railway lines if possible, and properly located with respect to organization to be served and roads available; then to construct at these sites the necessary platforms for projectiles, shelters for powder and fuses, roads for incoming and outgoing traffic—all with a view to safety precautions and concealment from observation.

"(d) To provide for each of these dumps adequate trained personnel, acquainted with kinds and types of ammunition, and to receive, sort and issue the ammunition.

"(e) To transport all ammunition from army dumps to corps and divisional dumps and to battery positions, so as to make the best use of all available means of transportation, railway, trucks and caissons, saving double handling wherever possible, and insuring the ammunition reaching the batteries in the kinds needed and at the times wanted.

"Our experience has shown that it is indispensable to fix the responsibility for the working of this whole complex process as closely as possible on one definite agency. Of course, one agency cannot perform the work independently of assistance and independently of coördination. Thus, railway transportation, dump selection and construction, and road traffic are necessarily matters involving special assistance and coördination; but these are merely incidents to the main executive problem of giving the necessary orders for regulating the flow of ammunition from army dumps to guns, and of controlling day and night the truck transportation required to move ammunition to the places where it is required."

THE War Plans Division committee modified the recommended organization of the A.E.F. Superior Board to the following extent:

"That the ammunition train in the division should be an integral part of the artillery brigade and that infantry ammunition should not be carried in this train but in the *divisional train*

heretofore called the supply train. The ammunition carried with the guns plus that carried with the combat trains plus that carried with the ammunition train should be 1½ days' battle fire for the artillery brigade.

"The corps ammunition train should be an artillery train. The ammunition carried with the corps guns plus that carried with the corps combat trains plus that carried with the corps ammunition train should be 1½ days' battle fire for the corps artillery. The corps ammunition train, thus organized, is sufficient for ordinary requirements of mobile warfare and will serve as a nucleus for organizing an artillery ammunition supply service suitable for stabilized warfare.

"The amount of infantry ammunition carried in the division train should be 60 rounds for each rifle in the division plus one-half the ammunition carried in the combat train for all machine guns, 37-mm. guns, Stokes mortars, or infantry howitzers."

Of this Superior Board Report, General Pershing, in his forwarding indorsement, made this comment. "The recognized ability of the officers who composed the Superior Board entitled their opinions to great weight. But I think that the work of this Board was undertaken so soon after the close of hostilities that the members were unduly influenced by the special situation which existed during our participation in the World War. Thus, in my opinion, the recommendations of the Superior Board are based upon the necessities of stabilized warfare in western Europe rather than upon the requirements of warfare of the character and in the theatre upon which we are more likely to be engaged."

So much for our historical narrative. We may now examine the organization and system which have resulted from the development which I have just related. What organizations have been provided for this ammunition supply service and how are they distributed through our typical army organization? The only organizations provided exclusively for ammunition supply are the Ordnance ammunition companies and the ammunition trains of the Field Artillery brigades. At the present date (December, 1935) an ammunition company consists of six officers and 164 enlisted men of all grades. This is not an ammunition transportation unit in any sense of the word. The transportation provided organically for this company consists merely of such transportation as may be required to move the company's baggage and other organizational equipment, and is limited to just a few trucks. This company is provided to supply the administrative and supervisory personnel required at ammunition establishments within the Army area. The ammunition trains of the Field Artillery brigade consist of truck-drawn ammunition batteries and animal-drawn ammunition batteries, grouped into ammunition trains in varying combinations, together with the necessary train headquarters and headquarters battery. A truck-drawn ammunition battery has available for the transportation of ammunition, twenty-four 3-ton trucks with a capacity of 72 tons. A horse-drawn ammunition battery has available for the transportation of ammunition, 24 escort wagons of 1½-ton capacity, each, giving a total ammunition carrying capacity of the horse-drawn battery of 36 tons. Such additional services as may be required in the form of labor in the operation of ammunition establishments, or in the preparation of ground for the establishment of an ammunition depot or distributing point, are furnished by labor elements of the Quartermaster Corps and by various units of the Corps of Engineers, as may be required. Certain ammunition loads are prescribed for various transportation elements of Quartermaster Corps trains in the corps and division, as will be indicated later on.

WE may now examine the distribution of these ammunition supply units. In the type field army organization, there is in the army service group an Ordnance service group consisting of, among other things, three Ordnance ammunition companies. As I have indicated previously, it is the function of these ammunition companies to provide the administrative and supervisory personnel for the army ammunition depots and such other army ammunition installations as the army may find it necessary to set up. In the army artillery there is an ammunition train consisting of a train headquarters and headquarters battery, and six truck-drawn ammunition batteries with a total capacity of 432 tons of ammunition. The army quartermaster service includes a number of motor transport companies for which, at the present time, no prescribed loads are set up. The ammunition train and the motor transport companies of the army quartermaster service constitute a pool of motor transport which may be used to such extent as the commanding general indicates in the transportation of ammunition.

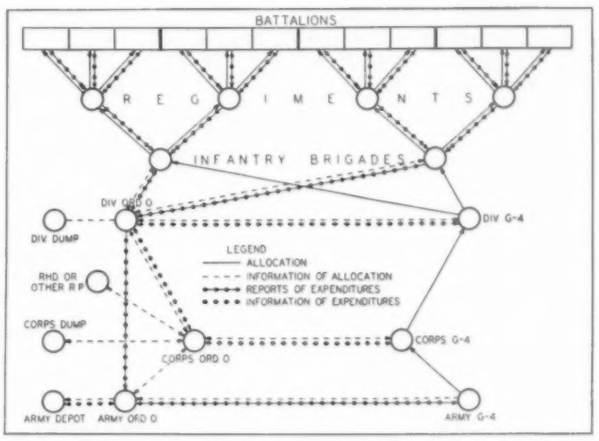

FIG. 2. ROUTING OF REPORTS OF EXPENDITURE OF INFANTRY AMMUNITION

In the corps, in the corps special troops organization, we find another Ordnance ammunition company. It is the function of this ammunition company to provide the administrative and supervisory personnel for such ammunition depots, dumps or refilling points as may be established and operated by the corps. Should the corps be operating independently, it would undoubtedly be reinforced, as far as the ammunition supply service is concerned, by at least one of the three ammunition companies in the army. In the corps artillery brigade, there is an ammunition train consisting of five truck-drawn ammunition batteries and the necessary headquarters and headquarters battery. These five ammunition batteries have a capacity of 360 tons. In the corps quartermaster service, in the corps quartermaster trains, approximately 150 tons of small arms ammunition and approximately 750 tons of artillery ammunition are carried. This amount of ammunition in the corps quartermaster train is carried, not only for the corps troops themselves, but also a certain amount is carried for the several divisions pertaining to the corps.

In the Infantry division there are no Ordnance ammunition units. In the artillery brigade of the Infantry division there is an ammunition train consisting of train headquarters and the headquarters battery, two truck-drawn ammunition batteries and, at this date (December, 1935), one horse-drawn ammunition battery. This ammunition train has a capacity of 180 tons of ammunition. In the train of the Quartermaster regiment in the division, there is transported approximately 60 tons of small arms ammunition.

It will be seen from the foregoing distribution of ammunition supply organizations and functions that there is a continuous intermingling of Ordnance, Quartermaster, and Field Artillery control and operation.

LET us now see how this ammunition supply service functions. The most recent exposition of this subject is contained in Part II of the Staff Officers' Field Manual, 1932, Chapter 5, Section II. Here we find the supply of ammunition broken down into the two categories of artillery ammunition and small arms ammunition. Considering first artillery ammunition, the army chief of artillery, through the army G-4, recommends to the army commander the allocation of artillery ammunition. Information with respect to these allocations is distributed through the army chief of field artillery to the army artillery units, and by the army G-4 to the army ordnance officer and the corps G-4. By the corps G-4, the information is distributed to the corps ordnance officer and the corps chief of field artillery, who makes the allocation directly to the artillery brigades in the several Infantry divisions composing the corps. Information of these divisional artillery brigade allocations is sent by the corps chief of artillery to the division G-4's. This is shown graphically in Fig. 1. (page 372).

It is provided in this same publication that the allocation and distribution of ammunition, except small arms, for the field artillery of the Infantry division, is the responsibility of the division artillery commander. To permit him to meet this responsibility he is provided with the ammunition train described previously, and a staff officer known as the artillery brigade munitions officer.

IN addition to the direct allocation of artillery ammunition and the channels through which these allocations and information connected therewith are distributed, it is necessary to provide methods and channels for reporting expenditures of artillery ammunition. The routing of these reports and the channels of this information are shown graphically in Fig. 1. It will be observed that the reports are routed directly from the division artillery brigades to the corps chief of artillery, and that information concerning these reports is sent to the division G-4. The corps chief of artillery routes his report directly to the army chief of artillery, sending information related thereto to the corps G-4 and the corps ordnance officer. The army chief of artillery routes his report to the army G-4, who, in turn, informs the army ordnance officer, and he, in turn, informs the army ammunition depots.

These reports are submitted daily and are consolidated at brigade headquarters for the regiments of the brigade. As a result of these consolidated reports, the corps chief of artillery allocates the necessary ammunition to the division. At the appropriate ammunition supply point, which may be a corps refilling point, an army ammunition depot, or a railhead, credits are set up for the several artillery brigades. The ammunition trains pertaining to these several brigades may then draw this ammunition from the prescribed ammunition supply point without further formality and as the need for resupply of ammunition arises. The ammunition train delivers the ammunition usually to artillery ammunition distributing points in division or corps areas in the amounts and kinds that are necessary for the successful accomplishment of the tactical mission assigned to the several artillery brigades. One distributing point usually is sufficient for a divisional artillery brigade. However, when the division is operating over a wide front or when the road-net is unfavorable, two or more distributing points may be established. From the distributing points, the ammunition is transported to the battery positions by the combat trains of the artillery battalion, and, in emergencies, by the ammunition vehicles of the firing batteries themselves. It is also possible to have the vehicles of the brigade ammunition train transport their loads directly to the batteries. In the normal case, however, the combat trains form the link between the distributing points and the batteries, and the ammunition trains provide the transportation connections between the distributing and the refilling points.

In the same Staff Officers' Field Manual, but in Part I, where the duties of the unit ordnance officer are enumerated, it is provided that he is responsible for "the supply of ammunition as far forward as the refilling point . . . .". Under a strict interpretation of this provision, the Ordnance Department responsibility for ammunition of all sorts would end at the refilling points, which are army, or possibly corps installations. It will be observed that in the set-up for the supply of artillery ammunition, this interpretation is followed. However, with respect to the supply of small arms ammunition, we find on page 81 of the current edition of Part II of this same manual, the provision that "the supply of small arms ammunition is a function of the ordnance officer".

THE routing of reports of expenditure of Infantry ammunition and the channels through which information concerning the same are distributed, are shown in Fig. 2. It will be observed that these expenditure reports are consolidated by regiments and by brigades and routed to the division ordnance officer, who, in turn, routes a consolidation of these reports to the army ordnance officer, giving information at the same time to his division G-4 and to his corps ordnance officer. The corps ordnance officer gives information of these expenditure reports to his G-4. The army ordnance officer routes his consolidated reports to the army G-4 and informs the army ammunition depots of these expenditures. Now these reports cover a period of time which is usually longer than that covered by the reports of expenditure of artillery ammunition (Fig. 2, page 373).

When the status of small arms ammunition supply of the division requires replenishment from the rear, the division ordnance officer arranges with the division quartermaster for the transportation of the necessary ammunition from a designated refilling point to the desired destination. These destinations may be small arms ammunition distributing points or division dumps, or perhaps both, depending upon the existing military situation.

The refilling points are indicated by the corps or army, as the case may be, and these same authorities also allocate the ammunition through channels shown on Fig. 2. It will be observed from this chart that an entirely different method is followed in the allocation of small arms ammunition as compared with the allocation of artillery ammunition. Generally speaking, allocations of small arms ammunition flow through the normal channels of supply for Class IV supplies—that is, through the G-4 of the army, to the G-4 of the corps, to the G-4 of the division. Each of these several G-4's inform their ordnance officers of these allocations and wherever applicable, these several ordnance officers inform the ammunition establishments under their control and also the units who will draw from these establishments.

Small arms ammunition distributing points are established usually at the rate of one for each brigade of infantry in the line. From these small arms ammunition distributing points the infantry combat trains deliver the ammunition to the troops.

(Part II of this article will be published in the next issue.)

INDEX TO ARMY ORDNANCE
VOLUME XVI

This issue concludes the sixteenth volume of this Journal. An index arranged by subject and author, with title pages for binding, is now in preparation. Copies will be furnished upon request to the Editorial Offices.

AOA

Chronicle

THE Senate Munitions Committee, voting 5 to 4, recommended the nationalization of the munitions industry. Senator Gerald P. Nye, of North Dakota, chairman of the Committee, and Senators Homer J. Bone, Washington; Bennett Champ Clark, Missouri; and James P. Pope, Idaho; were for Government monopoly. Senators Warren W. Barbour, New Jersey; Arthur H. Vandenberg, Michigan; and Walter F. George, Georgia; were opposed. The majority recommended "government ownership of facilities adequate for the construction of all warships by the United States Navy Department also all gun forgings, projectiles and armor plate and facilities adequate for the production of powder, rifles, pistols and machine guns necessary for the United States War Department." The recommendation exempted the aircraft industry "because airplane and engine construction is still a rapidly developing art."

Maj. Gen. Dennis E. Nolan, commanding general of the Second Corps Area and the First Army, has retired from active service. Command of the Second Corps Area has been taken over by Maj. Gen. Frank R. McCoy, while Maj. Gen. Fox Connor, commander of the First Corps Area takes over command of the First Army. Gen. Nolan was personally selected by General Pershing to accompany him to France where he organized and administered the Intelligence Service of the A. E. F., from its inception until its demobilization.

Alfred Duff Cooper, British War Secretary, addressing a territorial recruiting meeting at Manchester, called upon the leaders of the Church of England to denounce the "insidious doctrine of pacifism" as heresy. "I am told," he said, "that the doctrine of pacifism is rapidly spreading in Britain and that it is partly responsible for the failure of recruiting. . . . Today our regular army is 21 battalions smaller than in 1914 and additionally is short 12,000 men, while the territorials are 40,000 under their strength . . ."

CORN dynamite is potentially superior to nitroglycerin, according to a report to the American Chemical Society by its president, Prof. Edward Barstow, head of the University of Iowa Department of Chemistry. The new explosive is made possible by production from corn of a sugar-like substance known as inositol, hitherto unavailable because its extraction made it cost about $500 a pound. However, Dr. W. W. Walker of the chemistry department at Iowa has discovered a method of extraction that greatly lessens the cost of production so that many laboratories have started work on its possible uses. This new corn product is a solid containing twice as much nitrogen as nitroglycerin, though the proportions are the same. No infusorial earth or other inert matter need be added to form dynamite. The new extraction process makes the product from the "steep" liquor waste of the manufacture of cornstarch. Professor Barstow said the manufacture of cornstarch alone in the United States would furnish about a million pounds of inositol a year.

Tests of a fluctuating magnetic altimeter "proved conclusively the apparatus will function 100 per cent" its inventor, Ralph Lucas, Albany scientist, has announced. Its greatest contribution to aviation, it is claimed, is that it will warn pilots, even flying "blind" when they are approaching mountains or buildings. Lucas announced that he would probably submit the instrument to the U. S. Navy research department for further tests.

In a message to the Daughters of the American Revolution, President Roosevelt asserted that the United States would continue to press for an international arms reduction agreement and would not increase armaments unless forced by other nations. Speaking of the Administration disarmament policy he said, "First we propose to press continually for a limitation of armament by international agreement. Second, failing to get that, we will make no increase in our own armament unless other powers by increasing their armament make an increase by us necessary to our national safety."

AN "extremely dangerous" ammunition storage situation at Edgewood Arsenal, Md., would be corrected by the expenditure of $1,114,171 under the terms of a bill approved by the House Military Committee. This amount would provide for the construction of new buildings, roads and railroads at the arsenal. For the establishment of ammunition storage facilities at Aliamanu, Hawaii, $1,580,000 would be authorized by the same bill. The latter construction is necessary to provide for the defense of the Islands for, according to a War Department report, present storage facilities provide only a little over one-third the required capacity, a situation which Secretary of War Dern declared is "highly detrimental" to the defense of Hawaii.

A chart prepared by Col. John A. Wagner, Quartermaster Corps, based on the 24 raw materials considered essential to prosecute war, showed the United States has a relative self-sufficiency of 22.35 out of 24. The comparative self-sufficiency of other powers as ranked by Colonel Wagner is: Germany 6.20; France 5.37; Soviet Russia 4.95; Great Britain 4.50; Italy 1.92; Japan 1.77. To achieve industrial preparedness, however, war stocks of manganese and chromium should be built up in advance, as likewise should stocks of tin, iodine, nux vomica, opium and quinine. Colonel Wagner advocated a manganese reserve of 625,000 tons and a chromium reserve of 160,000 tons to insure a two year's emergency supply.

A new "vacuum ice box," to simulate the pressure and temperature conditions of altitude flying has been ordered as part of $50,000 worth of equipment being installed at the new physiological and biochemical unit at Wright Field, in charge of Capt. Harry G. Armstrong. The chamber, built of boiler plate, will provide a temperature of about 60 degrees below zero and pressure conditions comparable to those at an altitude of 80,000 feet. It will have three compartments connected by air locks, each of which may be used independently. The efficiency of instruments and the reactions of men and animals will be tested in the new chamber.

TWENTY-FIVE military planes are to be equipped with injectors instead of carburetors by the Army Air Corps, Matériel Division. The injector shoots a measured charge of gasoline into each cylinder just before it fires, thus eliminating a variable cylinder charge as occurs with carburization. The idea of using an injector originated at Wright Field in 1924 after fighting planes encountered carburetor trouble when flying inverted. The injector-equipped planes use about 7 per cent less gasoline than those using the same engines carbureted—their fighting range being thus substanially increased.

The Air Corps has recently adopted an optical gun sight, a new device which facilitates aiming a plane's machine guns. This improvement is sponsored by the Matériel Division. The device consists of a square of transparent glass mounted in front of the pilot on the windshield. A light beam within the cockpit casts a pattern of three crossbars on the glass, each with a numeral to indicate hundreds of yards. The pilot merely guides his plane until the target is seen directly at the intersection of one of the crossbars—his eye does not have to

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be in line with the gun sight, thus permitting great accuracy of fire during combat. The device was first used on a Curtiss A-14 attack ship at Wright Field, Dayton, Ohio.

"The peace movement has accomplished nothing," Rev. John Haynes Holmes declared before the Community Church in New York City. "In our commercial rivalries, our armament competitions, our diplomatic manueverings, we see the nations fighting, not openly, but covertly, and none-the-less fiercely and effectively. The peace movement is getting nowhere today because it is concerned only with pious gestures, beautiful but vain wish fulfillments, and more or less silly superficialities. A real peace movement must be a movement of drastic social change. . . ."

The Army's newest coast defense rifles, two 16-inch pieces installed at Puu Kapolei on the west coast of Oahu have been proof-fired to determine the strength and safety of their emplacements. The guns were tested with powder charges varying from 75 per cent of normal to 15 per cent above normal.

An order has been placed with the Pratt and Whitney Aircraft Division of the United Aircraft Manufacturing Corporation, East Hartford, Conn., for 200 14-cylinder, air-cooled two-row radial aircraft engines to be used for installation in and as spares for the 100 all-metal single-engine attack planes now under construction.

The seventy-ninth annual Newark (N. J.) Conference of the Methodist Episcopal Church adopted a resolution asking the General Conference of the church meeting in Columbus, Ohio, May 1st, "that the general conference declare that in the event of war involving the United States, the Methodist Episcopal Church will neither sanction nor support war."

An Army Air Corps of 4,000 combat planes and a reserve personnel of 1,350 fliers on active duty for not to exceed five years was approved unanimously by the House of Representatives. Also unanimously approved was the plan to create an Air Reserve Training Corps of young men between the ages of 17 and 24 years. Recruitment will be from students attending private flying schools, colleges and universities where Regular Army flyers will be assigned as supervisors.

Maj. Gen. Frederick W. Boschen has taken the oath of office as the new Chief of Finance of the Army.

Premier George Tatarescu of Rumania has announced a war budget increase of $8,760,000 over the $14,600,000 spent for national defenses in 1935-36.

The House Military Committee has approved a bill designed to protect Army military secrets from public disclosure. Under its terms, the Chief of the Chemical Warfare Service and the Chief Signal Officer of the Army may negotiate privately with reputable American manufacturers and let contracts to them for the construction of secret war materials. This bill seeks to extend the provisions of the legislation which has enabled the Ordnance Department, since 1908, to let contracts with individual manufacturers when necessary to preserve military secrets—thus avoiding competitive bidding and publication of specifications.

A world-wide campaign for peace is to be launched by the International Peace Workers under the chairmanship of Viscount Cecil of Britain. The program includes, restoration of the sanctity of international treaties, general disarmament, elimination of profit-making from armament manufacture, recognition of League sanctions, even force, if conciliation fails, and the recognition of the need for treaty revision by peaceful means.

More than 3,000 officers and men participated in the first maneuvers since 1927 of the entire First Cavalry Division, held within a radius of 25 miles of Marfa, Texas. The First is the Army's only cavalry division.

"Defence Against Gas", a new official manual of the British Army, treats the general and particular characteristics of gas defense. Although primarily an army publication, it is recommended also for the study of civilian gas defense.

One of the most discussed speeches made at the United States Chamber of Commerce convention in Washington was that by Dr. E. R. Weidlein, director of the Mellon Institute of Industrial Research, in which he described the opportunities for new industries and development of innovations in old ones—thus creating new economic demands, new jobs and new national wealth. "You have heard a good deal about technological unemployment," he said, ". . . I can really show you that the unemployment is always taken up by new developments. . . . I would say today that your automobile, in the light of what we know at present, is about 10 per cent developed. When you realize that you are getting 5 per cent efficiency out of the gasoline that you burn in your automobile, if somebody comes along and makes an engine that is 25 per cent efficient you are going to scrap the one you have and save by getting the new type of engine."

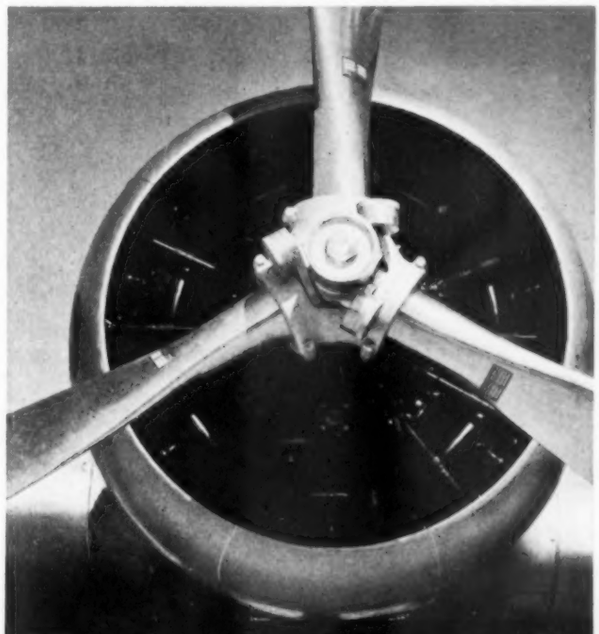
COL. John W. Wright, who sails July 3rd to assume command of the island garrison in Puerto Rico, will make his future home in the Casa Blanca, a fifty-room castle built over 400 years ago by Ponce de Leon in San Juan. The Casa Blanca, originally a fortress, remained in the de Leon family for over 200 years until taken over by Spain as a residence for its military governors. It is reputed to be the oldest continuously occupied residence in the Western Hemisphere.

With Great Britain inaugurating a new naval program calling for 38 new warships, including two 35,000-ton battleships, a record peacetime naval appropriations bill was passed by the House of Representatives, 212 to 73. The bill appropriates a total of $531,068,707 to provide for the construction of two capital ships at more than $51,000,000 each, as well as for 12 destroyers, 6 submarines and 333 airplanes. Provision is also made for a heavy increase in personnel and a fund of $5,000,000 to build up reserves of strategic war minerals.

Maj. Gen. Stanley D. Embick, of the General Staff, has been selected to succeed Maj. Gen. George S. Simonds as Deputy Chief of Staff. General Simonds has been made commandant of the 9th Corps Area at San Francisco and will sail from New York on June 2nd to take over the post. General Embick is now chief of the War Plans Division and has had 37 years of Army service. During the War he was a member of the Supreme Allied War Council.

DURING his lifetime, Col. James Barnes, who died in Princeton Hospital following a long illness, was author, war correspondent, explorer and lecturer. Following his graduation from Princeton in 1891, Colonel Barnes spent two years on the staff of *Scribner's Magazine* and two years as assistant editor of *Harper's*, later serving as editor of the *Book Lovers Magazine* and of *Appleton's Magazine*. From 1902 to 1906 he was literary adviser to D. Appleton and Co. He was also on the editorial staff of "The Photographic History of the Civil War." He organized and headed the Aviation School at Princeton in 1917 and the same year was commissioned a major in the aviation section of the Signal Officers Reserve Corps. Later he organized the Air Service Photographic Division at Washington and was then sent to France to take charge of aviation photographic work at the front. Near the end of the war he was recalled to this country to take charge of the United States School of Aërial Photography at Rochester, N. Y.

The United States Chamber of Commerce has reported that exports of American iron and steel were higher last year than at any time since the World War. The 1935 total of 2,108,000 tons exceeded the peak figure for 1929.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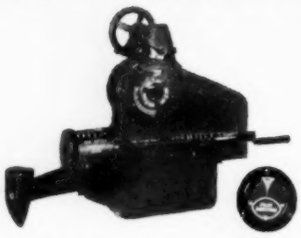

Improvements have been incorporated in, and features added to this Bomb Sight to supply the growing demands of modern bombing technique at higher altitudes and greater speeds. The D-4a is an exceptionally sturdy instrument, built to withstand vigorous field service with a minimum of maintenance. It has high mathematical accuracy, is convenient in use, is light in weight, and can be easily and quickly installed.
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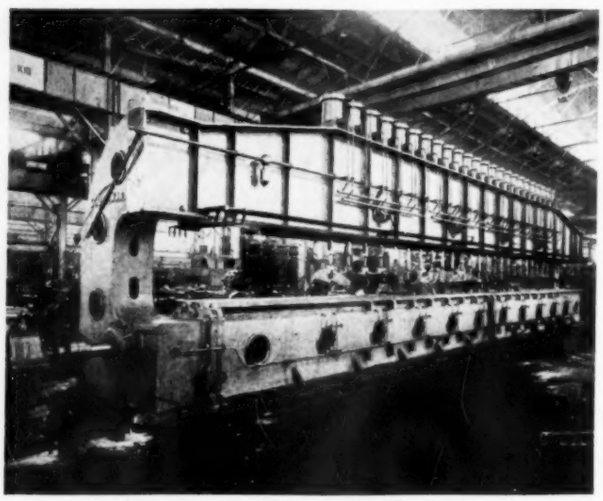
Professional Notes

Armor Plate Planer

A SPLENDID example of the time and technique required to build our major machine tools for the national defense, is the recent completion and installation of two 36-foot planers, built by the Baldwin-Southwark Corporation for the Philadelphia Navy Yard.

These planers, as described in the *Nickel Cast Iron News*, publication of the International Nickel Company, are made to machine special heat-treated armor plates, such as are used in battleship construction, with the greatest facility. The electrically-fed carriage glides along smoothly at a variable rate of from 15 to 45 feet per minute as the hard tool-steel bits



The Baldwin-Southwark Planer

plane from 1/100 to 1/4 inch from these heavy steel plates at widths up to one inch.

So enormous is this machine that it is anchored in five feet of concrete, which was poured on 30 pilings driven 60 feet into the ground. The planer is 60 feet in length and stands slightly over 15 feet from the floor level, while approximately a foot and a-half of the machine is below the floor. The planer weighs in excess of 210,000 pounds.

As the life of machine tools is largely determined by the ability of their ways to withstand wear, the Cramp Brass & Iron Foundries Company of Philadelphia, which produced the castings, used a nickel alloy iron of approximately the following construction: total carbon 3.20 per cent; silicon 1.30 per cent; manganese 0.85 per cent; nickel 1.00 per cent; chromium 0.30 per cent.

Ordnance Patents

RECENT patents for ordnance and related equipment include the following:

A novel arrangement of parts for a compact ordnance sight for use with mortars and small cannon; to James C. Karnes (No. 2,032,366).

A modification of the Browning automatic rifle to permit the

ammunition to be fed thereto by a belt; to Capt. Wiley T. Moore (No. 2,032,376).

An apparatus for the rapid testing of shells, so arranged that the head of the piston or ram moves against the packing to assure a perfect seal; to Lieut. Col. John G. Booton and Lieut. Franklin Mitchell (No. 2,033,144).

A pyrotechnic composition in which the magnesium or aluminum, or both, is alloyed with another metal which prevents oxidation; to Samuel Wiley (No. 2,033,966).

A rear sight which has a leaf pivoted to swing transversely of the base and other novel details of construction; to Maj. Thomas J. Heavey (No. 2,034,367).

A device in which the ductility of a wire absorbs the energy of a flare or the like to relieve the strain on a parachute; to William A. Gibson (No. 2,035,367).

A piston with a special provision for oiling for use in recoil mechanisms; to Lieut. Col. Gladeon M. Barnes (No. 2,035,450).

A traversing mechanism for turrets; to Harold W. Evans (No. 2,035,466).

A propellant powder which contains a small proportion of triacetin with nitrocellulose; to George C. Hale and Donald R. Cameron (No. 2,035,471).

A pyrotechnic composition consisting of specified proportions of barium nitrate, strontium nitrate and magnesium; to George J. Schladt (No. 2,035,509).

MILITARY CHESS BROUGHT UP TO DATE

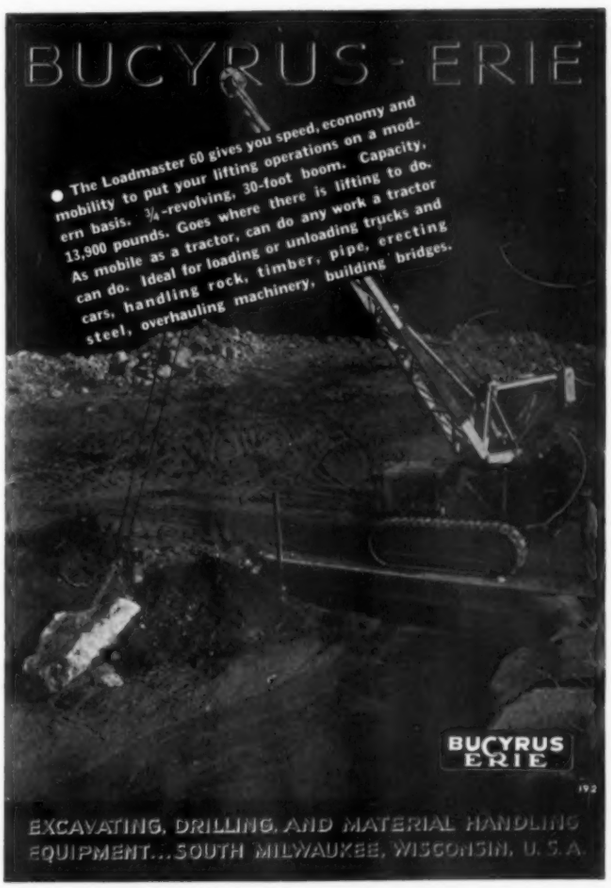
By F. W. Foster Gleason

WHEN the time-honored game of chess arose from the dim mists of the past (it is believed to be some four or five thousand years old), it was played with the aid of dice and so contained a considerable element of chance. But in the course of time this feature of the game was dropped, and chess became a game of pure skill. Some of the earlier changes in the game are not definitely known in detail, but for at least ten centuries chess has been played in substantially its present form, with but comparatively minor and gradual changes in its rules.

However, the science of the game and the style of play has steadily advanced; and this progress in science and mode of play has, with quite amazing consistency, followed the development of the art and science of warfare. For this most ancient and fascinating game of skill has always been regarded as preëminently a military game, in fact *the* military game of the ages. It is therefore most appropriate that the tremendous changes wrought in warfare by the advent of aviation should be incorporated into chess.

This difficult task has been most cleverly accomplished by one of our own Army officers. A patent has recently been granted to Lieut. Col. Walter Reed Weaver, Army Air Corps., for a "military game" which the inventor describes as "three dimensional chess", or "the game of chess with aërial warfare added". Since a game known as "third dimensional chess"—a purely mathematical complication of chess with no military feature whatsoever—is already in use, this name would appear to be unsuited to adequately describe Colonel Weaver's idea. His second choice is rather unwieldy by reason of its length, so I venture the suggestion that "modern military chess" might be a really descriptive and not-too-lengthy title for this new form of a time-tried game.

I believe that the fundamental soundness of Colonel Weaver's conception lies in the fact that he has kept the game of chess, intact and unchanged, as the basis of his invention, and has avoided undue and unnecessary complications. On the other hand, he has not hesitated to make his addition to chess radical enough to be consistent with the changes in modern warfare, brought about by the "third dimensional arm".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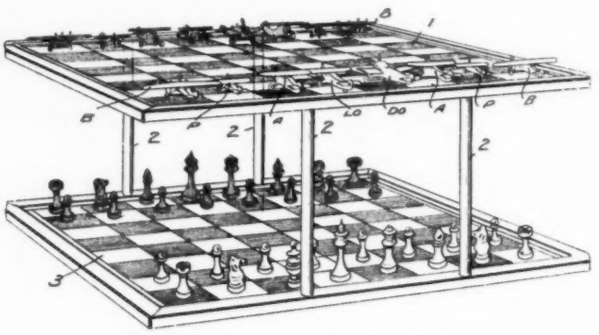
The accompanying illustration will show the general idea of the new game, almost at a glance, and with a few explanatory remarks, will serve to convey the theory of "military chess". As will be readily seen, the chessboard and chessmen of the lower board or "plane", are absolutely unchanged from the standard game of chess. The upper board is exactly similar in arrangement and coloring of the playing squares, but is made of transparent material, so that the lower board is well lighted. The pieces or "airplanes" on the upper board, eight to a side, are placed exactly over the chess pieces corresponding with them in power of movement. Thus the "bombers" move as do the chess rooks, the "pursuit planes" as the chess



The New Chessair Military Game

1.—Upper playing surface. 2.—Supports for upper playing surface. 3.—Lower playing surface. B.—Bombers (over Rooks). P.—Pursuit ships (over Knights). A.—Attack ships (over Bishops). LO.—Local Observation (over King). DO.—Distant Observation (over Queen).

knights, the "attack planes" as the chess bishops, the "distant observation plane" as does the chess queen, and the "local observation plane" as the chess king. Various rules limit the scope of action of the planes, thus cleverly simulating at least some of the limitations and advantages of the different types of airplanes in actual warfare.

The player whose turn it is to move, may make his move on either the upper or lower board, at his choice. The objective of "military chess" is precisely the same as that of the standard game of chess: namely, to do all the damage possible to the enemy pieces, and finally, to checkmate the opponent's king as quickly as possible. Thus we see that Colonel Weaver has very wisely not attempted to give us a new game, to be a fad for a short time and then to be forgotten, but has quite cleverly and soundly brought up-to-date the most ancient, and I think, the most fascinating of all games, save war itself.

It remains of course, for time, that greatest of all exposers, to show just how the game will "catch on" with chessplayers and with the general public, but I do not think that any man who is both a chessplayer and a military student, will be able to resist trying out the game at his earliest opportunity!

It is to be hoped that Colonel Weaver will be able to make his invention available to us all in the very near future, for I believe that it promises not only much entertainment, but that it will also add much to the future of the "royal game", and to the development of interest in things military.

Titanium Pigments

WITHIN the past few years, the manufacture of paints, fine grades of paper, white and light colored rubber goods, fancy leathers, printing inks, metal decorative coatings, white shoe finishes, and numerous other products, has been influenced greatly by the introduction of a group of white pigments which are quite unusual in character and performance, and which, as a class, have attained a position of major importance.

The products referred to are the titanium pigments, of which there are four general types, as follows: 1. Titanium dioxide, which is the commercially pure oxide of titanium. 2. Titanium barium pigment, which consists of approximately 25 per cent of titanium dioxide combined with precipitated barium sulphate. 3. Titanium calcium pigment, which consists of approximately 30 per cent of titanium dioxide combined with calcium sulphate. 4. Lead titanate, which is a chemical combination of titanium dioxide and lead oxide.

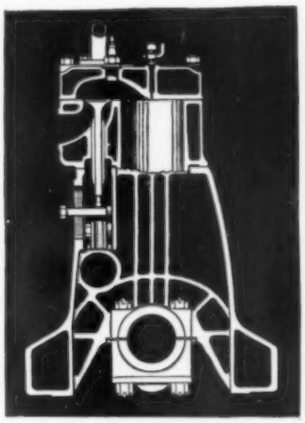
Titanium for many years was, and to a considerable extent, still is regarded as a chemical curiosity and a rare element. Actually, however, it ocupies a place about ninth in abundance among the 83 elements which make up the earth, being exceeded only by oxygen, silicon, aluminum, iron, calcium, sodium, potassium and magnesium. In general, titanium is found in most derivative rock and is a constituent of numerous minerals some 60 of which, containing titanium oxide either alone or in combination, have been identified and classified. Of these rutile, brookite and anastase, are substantially pure titanium oxide. The mineral which occurs in the greatest abundance however and which is used in the production of titanium pigments, is ilmenite. Theoretically ilmenite is an iron titanate, $FeTiO_2$ or $FeO\ TiO_2$. This ore illustrates the common occurrence of titanium in combination with iron. Deposits are found in several locations in the United States, Canada, South America (particularly Brazil), India, Portugal, Norway and Russia.

The discovery of titanium is credited to William Gregor, a priest in the parish of Menachan, Cornwall, England, who in 1791 investigated a black sand near his home and isolated the new element. In 1795 a chemist named Klaproth also extracted the element previously discovered by Gregor. Klaproth named this mineral "titanic earth" after the mythological race of titans, the first sons of the earth, and from this designation the word "titanium" was derived. The first practical study of titanium was conducted by a French chemist, Dr. A. J. Rossi by name, who came to America about 1870.

THE processes for manufacturing titanium pigments are much the same in the various plants now in operation. The richer grades of ilmenite ore, containing prefably 45 per cent or upwards of titanium, are delivered to the plant usually in the form of a moderately fine sand. After further pulverizing the ore is treated with concentrated sulphuric acid. A violent reaction takes place, forming a cake from which is leached a solution containing titanium and iron sulphates. After the necessary steps of clarification, reduction, and adjustment to proper concentration, this solution is stored in tanks. From this point on the treatment varies, dependent on the type of pigment desired. The method employed to make the composite known as titanium barium pigment will be described briefly. The standard process starts with the roasting of barytes ore and powdered coal to form what is known as "black ash." From this is leached the barium sulphide liquor which, after purification, goes to precipitating tanks where sodium sulphate is added. Through chemical reaction barium sulphate is formed with sodium sulphide as a by-product. The barium sulphate then goes through an exhaustive series of washing tanks and is finally reduced to pulp form on continuous filters.

Next a predetermined quantity of titanium sulphate liquor, adjusted to the proper concentration, is pumped to a large lead- and brick-lined precipitating tank and in this solution is suspended the proper amount of barium sulphate pulp. Upon heating at low pressure titanium hydrolizes from the sulphate solution and combines intimately with the barium sulphate pulp. When the reaction is complete the solid materials are passed through an extensive series of washing tanks to free them from all soluble impurities and are then concentrated

STRONG AND DEEP



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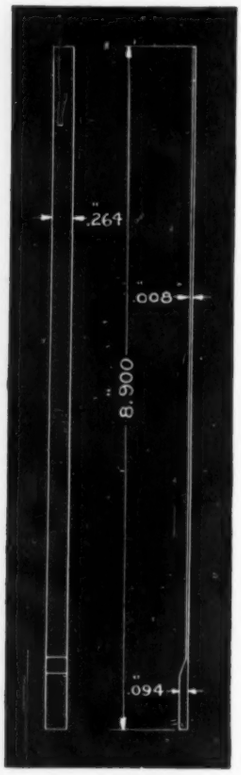

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in heavy paste on continuous filters. This paste is then fed to a calciner similar to a cement kiln in which it is subjected to a high heat. The process of calcination drives off all moisture and converts the pigment particles to the cryptocrystalline or microcrystalline structure, which is the probable cause for their unusual opacity. After calcination the pigments are cooled and then pulverized either by a continuous dry grinding system, in the course of which the fine particles are separated by air flotation and the larger ones automatically returned to the system for further pulverizing; or else by a wet grinding system where the finer particles are floated out by elutriation and the coarser ones are returned to process.

In the process of making titanium calcium pigment, calcium sulphate is prepared as the base by reacting either lime or calcium carbonate with sulphuric acid. Once the calcium sulphate is prepared in pulp form, the subsequent steps of precipitating, washing, filtering, calcining, grinding and packing are much the same as those already described for titanium barium pigment. In preparing titanium dioxide as such, a modified method must be used, such as a different concentration of the titanium sulphate liquor. No base is employed in the making of the commercially pure pigment, but precipitation is accomplished by hydrolysis as in the case of the composite pigments and the subsequent steps of washing, filtering, calcining, etc., are all similarly performed. In the manufacture of lead titanate, litharge (PbO) and titanium dioxide are combined and subjected to roasting at a relatively high temperature. The resulting product, which is a true chemical compound, has the formula $PbTiO_3$. The principal plants for the manufacture of titanium pigments, operated by Titanium Pigments, Inc., are located at Niagara Falls, N. Y.; Baltimore, Md.; St. Louis, Mo.; Sayreville, N. J., and Wilmington, Del. The rather rapid sequence in the building of these plants is a striking demonstration of the importance of the products.

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Book Reviews

A MODERN MILITARY DICTIONARY. By Col. Max B. Garber, U. S. Army, Retired. Washington, D. C., P. O. Box 3056 U Street Station. 1936. Cloth: $2.50; Leather: $2.75 (Post Paid).

THERE has long been a distinct need for a modern and comprehensive military dictionary. Those of us who strive for accuracy have been forced to consult the works of general lexicographers for our definitions of military terms, often times taking the word of an otherwise capable definer who did not know the precise characteristics of military language. That the military profession and many of its branches has its terminology is proved again by Colonel Garber's painstaking work in which he has compiled ten thousand terms—ancient and modern, American and foreign—embracing the entire military glossary. While brief and to the point, this new volume brings up to date and crystallizes all the comprehensive language of the soldier, his organization, his weapons and his works.

Colonel Garber began his thesaurus when he was instructor at the Infantry School. He has shown excellent judgment and leaves little for the most curious reader to seek in vain. While emphasis is placed on current military terms of the United States Army, the compilation includes important terms from other languages and the older forms, many now obsolete. We recommend this much-needed dictionary as a practical working manual of the language of his profession for the military man and for all others as a useful reference book of military terminology. O. E. D.

OLIVER HAZARD PERRY. By Charles J. Dutton. New York: Longmans, Green & Co. 1935.

"WE have met the enemy and they are ours." These words, written in pencil on the back of a soiled envelope, are among the best known in American history. Thus laconically did Oliver Hazard Perry, Commodore, U. S. N., aged 28, announce the victory of the United States naval forces under his command on Lake Erie over the British naval forces in those waters.

With but little more than this, the average American history dismisses Commodore Perry from further consideration and one is left to wonder who and what was this naval officer who could win undying fame, more from his report of victory than from the victory itself. Mr. Dutton satisfies this curiosity about one of our national heroes in this impartial and interesting life story which is the first biography of Commodore Perry to appear since 1840.

Oliver Hazard Perry was born in Rhode Island, August 23, 1785, of a line of aristocratic Quakers, the paternal branch of which had fled from England in 1650. His father, however, could scarcely be called a Quaker, because, although only a youth when the Revolutionary War broke out, it is hard to conceive a more romantic, heroic, or adventurous career than his. He was a member of a volunteer corps, privateer sailor and captain, British captive, sailor on the TRUMBULL, privateer again, and finally merchantman owner and operator, and then in 1798, a United States naval officer once more.

In the face of such a career it is no wonder young Perry aspired to go to sea. He entered the Navy in 1799 as a midshipman on his father's ship and saw service in the unofficial naval war against France—a war, incidentally, about which

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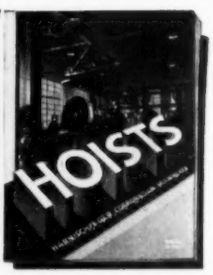

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most histories are silent. He also saw service against the Barbary pirates. Varied naval service, punctuated with periods of inactive duty, filled the years until the beginning of the War of 1812, when he was in command of a flotilla at Newport. In February, 1813, he was transferred to the Lakes, served briefly under Commodore Chauncey on Lake Ontario, and a month later was sent to Lake Erie.

His command there was non-existent, although five ships were in the process of construction at Erie. The difficulties which Perry encountered and conquered before his little flotilla was ready in August are striking commentaries on his resourcefulness and courage, the primitiveness of that period, and the unsupported independence—and isolation—of his command.

After only a little more than six weeks training, Perry's force met the enemy on September 10, 1813, with the results that are now known to every American schoolboy. The opposing naval force destroyed, Perry coöperated with the army of General Harrison and participated in the fighting around Chathan, where the Indian chief, Tecumseh, was killed.

Returning to the Atlantic coast, Perry was given command of the frigate JAVA, then being built at Baltimore. The British attack on Fort McHenry occurred shortly after Perry's arrival in Baltimore. In the defense of that city, Perry exerted his usual activities. The JAVA finally completed, Perry took her on a Mediterranean cruise, which was marred by an unpleasantness with one of his marine officers of such a nature as to lead to a court-martial and a duel.

Meanwhile, other unpleasantnesses were developing over the conduct of his second-in-command at the battle of Lake Erie. Perry was finally forced to submit court-martial charges against that officer. Before the court-martial could take place, Perry was sent on a diplomatic mission to South America. His mission completed successfully, Perry was stricken with yellow fever and died at sea on August 23, 1819, his thirty-fourth birthday.

Just how much Perry achieved by his outstanding victory on Lake Erie was not recognized in his day and is being given little consideration even today. Although his life from the age of thirteen was spent in the service of his country, there is but one outstanding achievement. He fought but one battle, the ships he built for that battle never fired another hostile shot. And as he was the hero of but one fight, so he has come to be known by that one-sentence report of that fight. Most Americans have forgotten—if they ever knew—the importance of that fight, but they have never forgotten how Perry announced his victory. R. M.

THE CAUSES OF WAR AND THE CONDITIONS OF PEACE. By Quincy Wright. New York: Longmans, Green and Company. 5/.

AS a wholesome antidote to the cumulous masses of suffocating peace literature which are being released upon a guileless public, this small volume will be appreciated. It consists of a series of lectures which were delivered at the Graduate Institute of Higher International Studies at Geneva. In his preface, the author states that the lectures "are not in any sense a treatise on the causes of war and the conditions of peace, but rather an outline for such a treatise". The work therefore lacks the thoroughness of true exposition, but the concise form and the sound commonsense will appeal to the reader who has not lost touch with reality.

Professor Wright, after a brief analysis of his subject from the point of view of the journalist, the diplomat, the philosopher, the historian, and the scientist, selects the methods of the last named and goes to work. The result is a refreshing objectivity unusual in a study which deals with a subject so close to the hearts of well meaning people, and which is so fruitful in desirable publicity. Incidently the professor reveals himself as more widely read on the subject of war than many writers who specialize on the military art.

The premise of any discussion of this nature necessarily is that peace is desirable. This is axiomatic, a direct heritage from the Sermon on the Mount, and accepted by us without question. That the author is not entirely satisfied to leave the matter in the realm of belief is evident, although his work is not cast to a scale that will admit of a thorough treatment of the question. However, to abstain from conflict, he points out, is not a trait of human nature. To maintain universal peace, humanity will have to submit to a certain amount of molding, and if this is to be done, the accuracy of the premise should be established beyond all doubt. Should the people set up laboriously an elaborate system for world peace and then find that they have lost the possibility of exercising their ancient right of destroying tyranny by force of arms, this would be the most cruel of ironies. It is stated that "Peace requires that no end should justify violence as a means to its attainment; consequently, that no person or group shall believe in any end so firmly that compromise, or at least postponement of its realization, is impossible." Quite soberly, we should examine this peace philosophy with care. Is it possible that responsible men wish humanity to adopt the attitude that there is no ideal worth fighting for?

The chapter headed "Fluctuations of War and Peace" is an interesting summary that deserves the attention of military men. Indeed wars have been so frequent in the last three centuries that a few rare years of peace are difficult to find on the chart. Even the pacific disposition of the United States may well be subject to doubt with only twenty years of peace in our national existence of one hundred fifty-eight years. Other lectures include discussions of the balance of power, the organization for peace, and the effect of public opinion. An excellent bibliography is provided.

J. M. E.

THE RECORD OF AMERICA. By James Truslow Adams and Charles Garrett Vannest. New York: Charles Scribner's Sons. 1935.

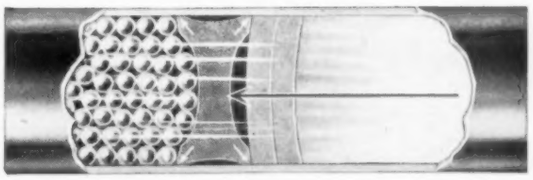
ONE of the co-authors of this book, James Truslow Adams, needs no introduction to American history readers. His "Epic of America" accomplished that. The other co-author is likewise a recognized historian, is the author of a history of the United States and a professor of history in a western college. From the pens of two such authors, one might expect a distinctly different history of the United States. Such expectations are not unrealized.

This book is not a mere political history of the United States. It is far more, and is fittingly entitled "The Record of America". The political happenings in a country are only a part of its history and only a portion of its development. Other parts of a country's history, and of equal and perhaps greater importance, pertain to the social, economic and cultural development of the country. The story of the growth and development of the United States is set forth in this book from this fourfold viewpoint.

The book begins with a portrayal of the American Dream—how the Old World denial of certain fundamental rights and liberties drove emigrants to the New World, determined to do there the things denied them in their native lands. From this determination came the American Dream. And the authors suggest that the American Democracy made possible by this Dream is now on trial, "to determine whether this nation, or any other nation so conceived, can long endure".

The early history of the European invasion of the American continent is based on the most recent research and shows how the conditions in Europe were ripe for this new development, what economic, religious and political forces were involved, and what was behind the rivalry of England, Spain and France for supremacy in the Americas.

When a conflict in the ideas of colonial government as held by Great Britain and the colonies resulted in the creation of a new nation, all the problems of the colonists were not solved by any



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means. The conflicts and compromises which took place before the United States were finally united are discussed not only from the viewpoint of their happening, but, more important to a student of history, of their significance.

Approximately half of the book is devoted to the political growth and development of the United States from the adoption of the Constitution to the present time, including a little more than two years of the present "New Deal" administration. It is interesting to note a historian's accounts of and comments on the "New Deal", the bank holiday, alphabetical administration, dollar devaluation, the N.R.A. and its demise, and the economics of the administration.

Interesting as these political happenings may be, they should not lessen the interest in and the importance of the other sections of the book which treat of the other phases of a national growth. Consequently, in these other sections we find valuable discussions as to how the winning of the West has influenced our national life and our character and attitude on affairs. The effects of the growth of industry and commerce, the development of the machine age and the day of huge corporations are shown. The history of our tariff and the growth of our banking system is briefly covered.

Social justice, about which one hears so much today, is generously covered. The march of democracy and the search for social justice spans the century and a-half from the days when the seekers for social justice crossed over into the untrammeled wilderness of the Ohio River valley to some of the proposed plans now under consideration for the economic readjustment of America.

While all these multiple developments were taking place, America was also growing culturally and intellectually and so this book presents a brief but adequate description of our early elementary education, our high schools, colleges, universities and churches. The amazing growth of American art, architecture, literature and science leads to the conclusion that the inhabitants of the United States have offered to them an opportunity for a cultural life as rich and happy as has ever been offered to any people.

But the story of a nation is a composite story. What about the individuals? What have they been doing while the nation grew, developed and prospered or suffered depressions; how have they lived; how have they benefited by their nation's progress? Those questions are answered in a liberally sized section dealing with life in the United States in colonial days, in 1800, in the mid-century, during the Civil War and in recent times.

That the student might not be unmindful of that basic contract between the people of the United States and their government, that contract which is the foundation of the American Dream and the basis of the American Democracy, the book closes with that contract—the Constitution of the United States. R. M.

THE LINCOLN LEGEND. By Roy P. Basler. New York: Houghton Mifflin Co. 1935.

THIS book is not a life of Lincoln in any sense of the word. Neither is it an effort to "debunk" Lincoln nor, as the author states in his preface, "a definitive study of his character and achievement; but rather—his purpose is—to show how poets, writers of fiction, dramatists and occasionally biographers have, with the help of the folk-mind, created about Lincoln a national legend or myth which in conception is much like the hero-myths of other nations." It is, consequently, a critical analysis of the mass of literature that has grown up around and about Lincoln.

That such an analysis is needed is evidenced by the fact that the more recent Lincoln bibliographies list more than 2500 titles to which must be added thousands of articles, stories and poems which have appeared in periodicals. In this book, Mr. Basler sifts this great material, separates fact from fiction, and history from hysteria and, in pointing out what accounts may be accepted on their merits, shows Lincoln as he really was.

As one reads this criticism of Lincolniana, one must be struck by the unrestrained invectives employed by Lincoln's enemies on the one hand, and on the other hand, by the unlimited laudations poured out by his admirers. To one group he appears as a fiend; to the other group, he is second only to the Man of Galilee. The book thus serves as an interesting and valuable contribution to a study of the psychology of the American masses and their spokesmen as, driven by political partisanship and emotional hysteria, their reactions range from complete condemnation to almost holy canonization. From that viewpoint, if perhaps nothing more, this book is worthwhile. R. M.

STONEWALL JACKSON. By Col. G. F. R. Henderson, C. B. New York: Longmans, Green and Co. 1936. $5.00.

THIS is the fifteenth printing of Colonel Henderson's classic biography of the great Stonewall Jackson. First printed in August, 1898, the work has heretofore been in two volumes. This, the authorized American edition of the original text, is in one volume. The fourteen earlier printings have worn out the original plates and made it necessary entirely to reset the text and cast new plates—in itself is a measure of the worth of Colonel Henderson's work. Long acknowledged to be the leading biography and military analysis of General Lee's right arm, what greater tribute could any book merit than that after fourteen printings through thirty-eight years it still holds the center of the stage for authenticity and appeal?

Among the great strategists of military history Stonewall Jackson stands the peer of any and the superior of most. "From his first engagement in 1861, until he fell mortally wounded at Chancellorsville twenty-two months later, his brilliant exploits struck terror into the North; his strategy immobilized huge forces of the enemy and kept them on the defensive; he struck swiftly and decisively from the most unexpected and impossible quarters; with starved, ragged, barefoot troops he overwhelmed the immeasurably superior forces of the enemy. When he fell, it was as if Lee's right hand had been cut off—from that moment the fortunes of the Confederacy began to decline." For generalship no cause could boast of greater than that of Lee and Jackson.

The late Colonel Henderson succeeded in keeping the dispassionate attitude of the highly trained military historian. He wrote of Jackson almost as objectively as did Dr. Douglas S. Freeman of Lee. Henderson's—like Freeman's—is one of the great biographical studies and military critiques of our time. Now that Dr. Freeman has written the life of Lee for all time, the publishers of Henderson's "Jackson" are to be thanked for making available this one volume work because both studies are indispensable to the record of the chivalry and genius of 1861-65. As in the earlier editions, this book is accompanied by excellent maps of the broad territory over which Stonewall Jackson operated. Without Colonel Henderson's work the library of any student of military history is sadly deficient. E. O. A.

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In the World War it took from a year to eighteen months to produce our implements of defense. Many lives and great expense would have been spared if our industries had known their mission in advance.

The only way to prevent such costly confusion in a future emergency is to have available men with the knowledge of how to produce the intricate equipment our defense forces need. This knowledge the Army Ordnance Association seeks to keep alive. It invites all members of American industry to help—they are the Minutemen of today. Won't you recommend a friend to be one?

ELIGIBILITY

Full membership in the Association shall be open to all men who are American citizens and who are interested in promoting the cause of industrial preparedness, particularly in connection with the design, procurement, production, manufacture, inspection, test or supply of Ordnance material.

THE ARMY ORDNANCE ASSOCIATION
APPLICATION FOR MEMBERSHIP

Date .....

The Membership Committee,
Army Ordnance Association, Mills Building, Washington, D. C.

I hereby apply for membership in the Army Ordnance Association and enclose annual dues ($4.00) which include ARMY ORDNANCE, the bimonthly journal of the Association, and all other membership privileges for one year. I certify that I am an American citizen.

Name .....
(PRINT LEGIBLY)
Address .....
.....
Business Connection .....
Signature .....
Recommended by .....

Membership in the Association includes the right to affiliate with a local post and to participate in its activities. Checks should be made payable to: Treasurer, Army Ordnance Association.

INSIGNIA
OF
THE ARMY ORDNANCE ASSOCIATION

THE medal of the Army Ordnance Association is suspended on the traditional Ordnance colors: crimson bordered with yellow and piped with black. The medal itself is struck from bronze of unusual historical significance. This material was used in a 6-inch howitzer of British manufacture which was captured by the German Army during the World War on the Russian front. Reconditioned by the Germans, the gun was put into service by them in the Argonne where it was captured by the 77th Division, American Expeditionary Forces. As shown in the accompanying illustration, the medal has on its obverse side the United States eagle and shield, the flaming bomb of ordnance and a superimposed scroll of the Association. The ribbon is of best quality grosgrain silk 1⅜ inches in width attached to a hidden bar pin with safety catch. The medal and ribbon are authorized for wear on the uniform at association functions in accordance with Army Regulations 600-40. All insignia of the Association are designed and manufactured by the well-known firm of medalists, Messrs. Bailey, Banks and Biddle of Philadelphia.

THE MEDAL

Price boxed $1.00

THE EMBLEM

The emblem of the Association for wear on the lapel of civilian dress, is furnished in bronze and 14 kt. gold. It is ⅝-inch in diameter and has on its face the ordnance bomb in black and crimson with the name of the Association on the outer edge.

Emblem in 14 kt. gold $3.50

Emblem in bronze . . . . . $ .50

THE MINIATURE MEDAL

The miniature medal is a replica of the larger medal ¾-inch in width suspended from a ribbon in the Association's colors. It is recommended for wear on civilian evening dress and is of standard size to accompany similar decorations.

Price 75c

THE LAPEL EMBLEM

THE BAR RIBBON

A bar ribbon 1½ inches in length by ¼-inch in width in crimson, yellow and black, authorized for wear on the uniform instead of the medal.

Price 25c

THE LAPEL BAR

For wear on the lapel of civilian dress, the miniature colors of the Association enameled on metal, gold plated with clasp.

Price 50c

The standard ribbon of the Association identical with that on which the medal is mounted (1⅜ inches wide) is sold in lengths of not less than one-quarter of a yard.

Ribbon (1⅜ inches wide) per yard . . . $2.00

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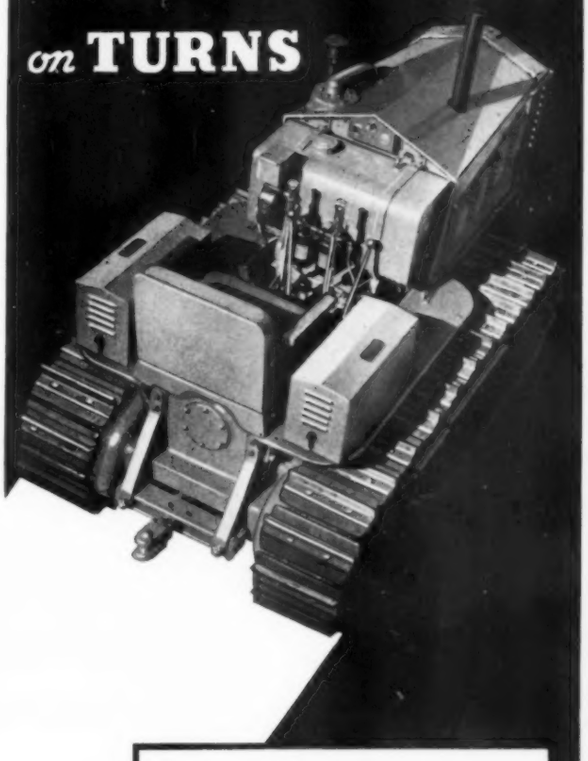
Index of Advertisers

ADVERTISER	PAGE
Addressograph Multigraph	386
Allegheny Steel Company	389
Allis-Chalmers Manufacturing Company	326
American Armament Corporation	326
American Brakeblok Corporation	387
American Brass Company	383
American Car and Foundry Company	380
Astor Hotel	387
Bankers Protection Company	383
Bucyrus-Erie Company	379
Cleveland Tractor Company	391
Cleveland Twist Drill Company	392
Climax Molybdenum Company	III Cover
Crane Company	392
Cutler-Hammer, Inc.	376
du Pont de Nemours & Co., E. I.	IV Cover
Frick-Gallagher Manufacturing Company	326
Gaertner Scientific Corporation	378
General Electric Company	388
Gulf Refining Company	377
Harnischfeger Corporation	384
International Nickel Company	II Cover
Jones & Laughlin Steel Corporation	381
King-Seeley Corporation	378
Kohler Company	380
Koppers Construction Company	388
Lynchburg Foundry Company	386
Monroe Calculating Machine Company	392
National Bearing Metals Corporation	379
Reo Motor Car Company	388
Republic Steel Corporation	392
Russell Manufacturing Company	382
Scovill Manufacturing Company	382
Sperry Gyroscope Company	325
Texas Gulf Sulphur Company	382
Timken-Detroit Axle Company	325
Timken Roller Bearing Company	384
Titanium Pigment Company	376
Trojan Powder Company	389
Union Carbide & Carbon Corporation	387
United Aircraft Manufacturing Corporation	377
Waukesha Motor Company	381
Western Cartridge Company	385
Wheeling Steel Corporation	385
York Safe & Lock Company	388

NO POWER LOSS on TURNS



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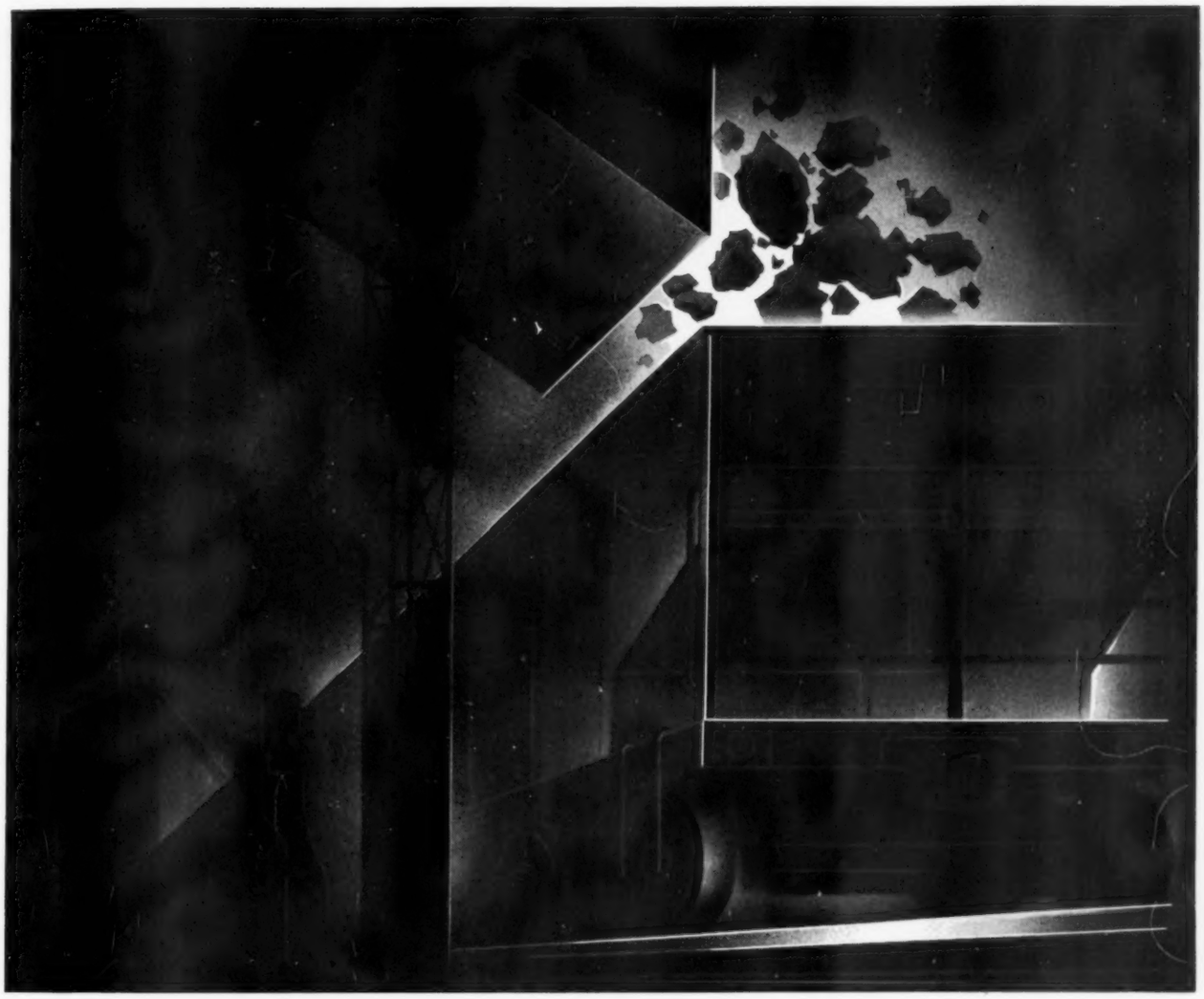

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